NEWFIELDS

September 30, 2008
NewFields Project No. 0473-002-900
Electronic Transmittal

Mr. Phil Harrigan
Chino AOC Project Manager
New Mexico Environment Department
3082 32nd Street By-pass, Suite D.
Silver City, New Mexico 88601

SUBJECT: CHINO MINES HANOVER/WHITEWATER CREEK IU DRAFT ECOLOGICAL RISK ASSESSMENT

Dear Mr. Harrigan:

Attached you will find a draft version of the Hanover/Whitewater Creek IU Ecological Risk Assessment for your review. As discussed, this draft version is intended for internal review by NMED and its partners including the US Environmental Protection Agency, New Mexico Department of Game and Fish, and the US Fish and Wildlife Service.

We are providing an electronic copy (in Adobe portable document format [pdf]) to all recipients of this letter. We are also providing a paper (i.e., 'hard') copy to you and Mr. Schoeppner. If other recipients would like a hard copy, please contact us at (303) 442-0267 or mlewis@newfields.com.

If you have any questions or comments, please do not hesitate to call me at (303) 442-0267 or Joe Allen at (724) 387-1067. Thank you.

Sincerely,

NEWFIELDS BOULDER, LLC

Mark Dunn Lewis, PhD
Project Manager

Attached: H/WCIU ERA Report as discussed.

cc:

Jerry Schoeppner, NMED
Mark Purcell, USEPA
Rachel Jankowitz, NMGF
Russ McRae, USFWS

9644682

Ecological Risk Assessment for the Hanover/Whitewater Creeks Investigation Unit

September 2008

Prepared for:

New Mexico Environment Department

Silver City Field Office
3082 32nd Street By-pass, Suite D
Silver City, New Mexico 88061

Prepared by:

NEWFIELDS

2500 55th Street Suite 200
Boulder, Colorado 80301

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION AND PURPOSE

This document presents the results of the Ecological Risk Assessment (ERA) for the Hanover and Whitewater Creeks Investigation Unit (H/WCIU) at the Chino Mine Investigation Area, Grant County, New Mexico (the site). The Chino Mine site, located approximately 12 miles southeast of Silver City, includes open pit copper mining facilities, rock stockpiles, leach stockpiles, mineral processing facilities, and tailings impoundments (Figure 1.0-1). Chino Mines Company (CMC) controls approximately 116,000 acres around the mining and mineral processing facilities.

In December 1994, CMC and the New Mexico Environment Department (NMED) entered into an Administrative Order on Consent (AOC) to conduct environmental investigations at the Chino Mine site and surrounding area as appropriate. The AOC requires that a Remedial Investigation/Feasibility Study (RI/FS), including human and ecological risk assessments (ERAs), be completed for each of the following Investigation Units (IUs):

- Lambright Draw;
- Hanover Creek Channel;
- Whitewater Creek Channel;
- Smelter;
- Hurley Soils; and
- Tailings Impacted Soils.

For practical and logistical reasons, the Hanover Creek and Whitewater Creek IUs, and the Smelter IU and Tailing IUs have been combined for performing the RI/FS investigations. To date, the RI/FS investigation is complete for only the Hurley Soils IU.

CMC and NMED agreed to conduct a baseline ERA (BERA) for the combined IUs based on suggestions that an ERA could be more effectively conducted on a site-wide basis. An Ecological IU was designated for this purpose and added to the AOC in December 1995 (NMED 1995). The Ecological IU encompasses areas of the other IUs that may contain ecological resources and may be affected by contaminant release (NMED 1995).

The site-wide BERA focused on areas of the site that may have been affected by historical release of contaminants from mining and milling operations. In accordance with the AOC, entered into by CMC and the New Mexico Environment Department (NMED) in December 1994, current potential sources that are operated under state or federal permits would not be considered in the risk assessment process, but areas affected by historical releases occurring from the sources prior to permitting are to be addressed if data from the RIs indicate contamination.

The site-wide BERA, completed in December, 2005 was conducted in accordance with United States Environmental Protection Agency (USEPA) guidance for ERAs at Superfund (Comprehensive Environmental Response, Compensation and Liability Act of 1980 [CERCLA]) sites (USEPA 1992, 1997). While the Chino site is not a Superfund site, the intent of the AOC is to produce CERCLA-like investigations and remedies. More recent general guidance on conducting ERAs (USEPA 1998) was also used in planning, terminology and the risk characterization approach of the BERA.

Because the RI/FS investigations were not complete when the BERA was, the nature and extent of contamination in the IUs has not been fully characterized. Therefore, the BERA design was focused on identifying chemicals of potential concern (COPCs) for ecological receptors, characterizing stressor-response relationships for key COPCs, and developing risk-based tools for further evaluating ecological risk in individual IUs as more complete nature and extent characterization become available from RI/FS investigations. As described in Section 1 of the site-wide BERA Report (NewFields 2005), and detailed in Technical Memorandum No. 1(TM-1) (Schafer 1999), the Chino ERA study design was based on assessing risk along a gradient of contamination, indicated by soil copper concentrations and pH described in the baseline remedial investigation (BRI) (CMC 1995). The tools provided in the site-wide BERA allow for a streamlined ERA approach for assessing each IU as additional RI/FS data become available.

IU-specific ERAs are being performed to include data from RI/FS investigation that were not available for the site-wide BERA. The results of the site-wide BERA are relied upon in this assessment in order to focus assessment on the risk characterization of the H/WCIU in terms of their site-wide contribution to risk and in order to help focus risk management decisions within this IU.

The H/WCIU is assumed, in this document, to include all areas within Hanover and Whitewater Creeks extending from the northern AOC boundary at Highway 152 (Figure 1.0-1) downstream to the southern extent of sampling approximately eight miles south of Tailings Pond #7. Also included in this risk assessment are the portions of Whitewater Creek from the southern AOC boundary to the San Vicente Arroyo and a small area east of Whitewater Creek where there has been evidence of the creek breaking out of its channel. The H/WCIU does not include those areas that are part of the Hurley Soils IU, Smelter and Tailings Soils IUs, IU, Lampbright Stockpile IU or the operational areas of the site.

Within this corridor, the lateral extent of the H/WCIU was based on the fluvial geomorphological features associated with the current and historic flowpaths. Vegetated (or potentially vegetated) fluvial overbanks and terraces identified by Golder (2000) were included in the analysis of exposure to terrestrial receptors including the vegetation and faunal receptors. Active channel sediments and point bars were not included in the analysis because these areas lack habitat that would be used by wildlife in ways that would result in important completed exposure pathways such as ingestion.

Aquatic habitats in the H/WCIU are generally limited due to lack of persistent sources of water. Temporary pools that develop from precipitation events were evaluated for potential risk to amphibians and aquatic invertebrates that may utilize the pools. In some locations such as Bayard Canyon and the James Canyon impoundment, more permanent pools exist due to groundwater seeps or local springs. Water and sediment analysis from summer rainfall pools and persistent pools were used in this analysis. In addition, a 'future scenario' in which higher, more persistent flow was evaluated using results from leach testing of sediments from the active channel.

1.1 Summary of Problem Formulation

A full problem formulation discussion including a history of releases and overall ecology of the AOC area is presented in the site-wide BERA Report (NewFields 2005). The problem formulation used to develop the overall study design for the Chino ERA is focused in TM-1 (Schafer 1999). A detailed discussion of the IU and history is provided in the Phase I Remedial Investigation (RI) report (Golder 2000).

The potential chemical stressors at the site consist primarily of metals, associated inorganics (e.g., sulfate) and acidic pH. The site-wide BERA identified potentially complete exposure pathways that were used to evaluate the risk of direct effects on ecosystem components from chemical stressors associated with the site. The site-wide BERA also includes indirect effects such as a loss of nesting sites or prey base.

1.1.1 Site Description

Major topographic features in the AOC investigation area include the Cobre Mountains and the San Vicente Basin. Erosion of the plateau surface in the Cobre Mountains southeast of Bayard has resulted in a series of even-crested, southward-sloping ridges that gradually become low hills. The topographic high within the AOC investigation area is approximately 7,700 feet.

The San Vicente basin is a broad lowland that extends northward from the Mimbres Valley. The basin terminates against the Big Burro and Little Burro Mountains on the west, Silver City and the Pinos Altos ranges on the north, and the Cobre Mountains on the east. The slope of the terrain is from these mountains toward the San Vicente Arroyo. The San Vicente Basin is characterized by several dry, sandy washes and gullies. Elevations in this area of broad plains range from about 5,700 feet near Hurley to 4,500 feet at the confluence of Whitewater Creek with the San Vicente Arroyo.

The geology of the H/WCIU is described in detail in the Phase I H/WCIU RI. The soils and sediments in the H/WCIU are largely derived from mineralized sources present in the headwater portions of the watershed. Golder (2004) conducted a background sediment investigation in order to determine pre-mining metals concentration in H/WCIU soils/sediments derived from the various upgradient mineralized materials. By observing vertical soils profiles, Golder (2004) provided indications of natural background levels derived from copper-rich materials in the Santa Rita Stock and the Hanover-Fierro stock.

Hanover and Whitewater Creeks flow through areas of alligator juniper and oak woodland vegetation communities in the northern portions of the drainage. Both creeks also flow through residential and historical mining areas in the upstream portions of their drainages. South of Bayard, Whitewater Creek flows through primarily mesquite/mixed-grama shrubland and fluvial forests until south of the mine facilities where the vegetation community grades into a mixed grama herbaceous community southward to the San Vicente Arroyo. Smaller drainages flowing from the higher elevations west of Whitewater Creek flowing toward the creek generally flow through mountain mahogany shrubland in the higher elevations (above about 6,000 amsl) on the south-facing slopes in the northern sections of the IU downward into the mesquite/mixed grama habitats in the lower elevations of the site (Figure 1.1-1).

1.1.2 **Overall Conceptual Site Model and Study Design**

CSMs have been used to describe the Chino Mine site in several documents (CMC 1995; Schafer 1999a, 1999b; Golder 2000). The potentially complete exposure pathways and associated potential effects used to guide the design and analysis of the site-wide BERA are shown in a conceptual site model (CSM) shown in Figure 1.1-2, and is unchanged from the CSM used in the site-wide BERA.

For riparian areas, the primary contaminant sources and release mechanisms are fluvial transport and to a lesser extent, smelter emissions and windblown tailing (Figure 1.1-2). Prevailing winds tend to be from the northwest (CMC 1995). Therefore, soils in areas to the south and east of the smelter and the tailing impoundments are likely to be most affected by dryfall from these aerial sources. The entire system is likely to be affected due to fluvial transport of materials from mining areas to the north and air/wind deposited materials adjacent to and downstream of the smelter and tailings impoundments. Although the ephemeral drainages east of Whitewater Creek may have been directly affected by dryfall, another effect on the drainages may be the downgradient erosional transport of affected soils and tailings into the drainages. Through this mechanism, COPCs could concentrate in fine materials deposited on soils along the drainages, as well as in the active channel sediments.

When the ERA was started, Phase I RIs had not been completed for any of the IUs. Therefore, the nature and extent of contamination had not been fully characterized. As a result, the overall goals of the analysis were to determine whether site conditions represent a risk to ecological receptors and, if so, to develop risk criteria that can be used to assess the potential for risk in areas that had not yet been characterized through the RI process.

The overall technical approach to sampling and risk analysis was based on a modified "gradient" approach (USEPA 1997) in which a suite of analyses was performed at sites selected to represent the range of observed copper concentrations and pH. Copper was identified as a key COPC based on results of the SLERA and the Phase I ERI (WCC 1997). The general objective was to identify a combination of COPC concentrations, pH, and other environmental factors that are protective of assessment endpoints, and then to apply these findings to future data on nature and extent of contamination.

A total of 34 sampling locations were identified for the ERA, including locations generally along an west-east gradient of copper concentrations and pH observed along the east of the former smelter location, and other locations along the Hanover and Whitewater Creek corridor, as well as other parts of the site that represented various copper and pH conditions. A reference area was identified in a portion of the San Vicente wash approximately 6 miles southwest of Hurley. The reference areas were not intended as ideal reference areas in the traditional sense. Rather, they were intended to represent a condition in the gradient approach in which copper was relatively low and soil pH was high, compared to the study area. Synoptic sampling of surface and subsurface soil, vegetation, invertebrates, and small mammals was conducted at each location. Phytotoxicity testing was conducted on soils from each of the 34 ERA locations.

1.1.3 Assessment Endpoints

Assessment endpoints are explicit expressions of the ecological resources that risk managers wish to protect for a given site (USEPA 1992, 1997, 1998). The BERA problem formulation identified a set of assessment endpoints based on ecological relevance, potentially complete exposure pathways, taxonomic groups that may be sensitive to chemical stressors and are potentially exposed, and site management goals (Schafer 1999).

The assessment endpoints are accompanied by "risk questions" described by USEPA (1997) as the questions the ERA will attempt to answer regarding whether or not assessment endpoints could be adversely affected by exposure to COPCs. They form the basis for identifying the specific analyses to be conducted and the data needed to perform the analysis. In some cases, risk questions may be stated as risk hypotheses (USEPA 1998) used in identifying the data collection and analysis to be performed. Evaluation of risk hypotheses is not necessarily equivalent to formal statistical tests of null hypotheses (USEPA 1998).

The assessment endpoints and risk questions used to guide the development of the site-wide BERA are presented in Table 1.1-1. The assessment endpoints can be broken down into three main categories with subcategories as follows:

Terrestrial Vegetation as Wildlife Habitat

- Ephemeral drainages

Terrestrial Wildlife

- Herbivorous, insectivorous and omnivorous birds
- Raptors
- Herbivorous, granivorous and omnivorous small mammals
- Ruminants
- Mammalian predators

Aquatic Receptors

- Amphibians
- Aquatic invertebrates and fish community

1.1.4 Site-wide BERA Conclusions

As noted above, the site-wide BERA study design was based on assessing risk along a gradient of contamination, indicated by soil copper concentrations and pH described in the BRI (CMC 1995) and along the riparian areas of Hanover and Whitewater Creeks. The site-wide BERA assessed potential risks to each of the assessment endpoints at the CMC site. Some potential for risk was identified for several receptors evaluated in the site-wide BERA. The conclusions reached in the site-wide BERA regarding potential risks are summarized below:

1) Metal concentrations have apparently been increased, and soil pH decreased, by site operations in some areas of the site; concentrations are most elevated in surface soils;

2) Because the bioavailable fraction of metals is also increased due to the depressed soil pH, metal exposure is also apparently increased;

3) A wide range of exposure conditions exist at the site, corresponding to both elevated metal concentrations and depressed pH; and

4) A wide range of exposure conditions exist in a demonstrable gradient with distance from the smelter and tailing impoundments (especially to the southeast of the smelter and the old Lake One area).

Vegetation

Overall trends identified from results of the site-wide BERA analysis indicated that:

1) Differences in upland vegetation community structure and composition were observed between study and reference area locations, and among study area locations; locations closest to the sources and containing the highest concentrations tended to have lower richness and cover than areas further from the sources;

2) Ephemeral drainage communities tended to have richness and cover similar to that of the upland reference areas. However, communities may not be comparable because of the wide range of conditions among ephemeral drainages; and

3) Phytotoxicity testing indicated that soils from some areas of the site closest to the mine facilities were more toxic than reference area soils, and more toxic than study area locations more distant from the mine and mineral processing facilities.

The stressor response analysis presented in the site-wide BERA evaluated whether the potential exposure to terrestrial plants from site soils was correlated with the effects on community structure and (laboratory-based) phytotoxicity. The analysis indicated that a measure of available copper (cupric ion activity [pCu2+]) was the best overall predictor of field and laboratory vegetation response variables. Several measurement endpoints including community species richness, total canopy cover, stem weight and length (laboratory studies), and root weight and length (laboratory studies) were more highly correlated with pCu2+ than with any other measure of metal concentration (Table 1.1-2). For other measures including seedling emergence, survival and the number or rhizobium containing root modules (alfalfa) were more highly correlated to water-soluble copper, but in all cases pCu2+ was one of the most highly correlated values for those measures as well. Bioavailable copper was identified as the risk driver for potential effects to terrestrial vegetation in the site-wide BERA.

The site-wide BERA concluded that elevated copper and other metals, combined with depressed pH, have led to higher risk of phytotoxicity for some areas of the Chino Mine site, particularly those areas closest to the smelter and tailings impoundments such as ERA-01, -02, -03 and -07 within the Smelter and Tailings Soil IUs (S/TSIU). The effects are highly dependant on soil pH since some locations within the S/TSIU (ERA-11, -12, -13, -14 and -15) had elevated copper concentration, but relatively high pH and exhibited little or no evidence of phytotoxicity in field measurements and/or laboratory exposure studies.

The site-wide BERA also indicated that other COPCs could contribute to toxicity under low pH conditions, including cadmium, lead and zinc which are also elevated at several riparian areas in the upstream portion of the H/WCIU primarily associated with historic mining operations. Additionally, non-site COPCs such as aluminum and manganese could also be toxic when present at natural concentrations in soils where pH is less than 5.0. Physical conditions and historic land use (i.e. cattle grazing) also affect vegetation at the site and could be responsible for some of the variability observed in the plant communities, and could also affect overall wildlife habitat quality.

The pCu2+ was highly predictable from soil pH and total copper concentration. The models derived in the site-wide BERA are presented in Table 1.1-3 along with the r-squared values from the regression analyses used to create the models. To help guide the vegetation risk characterization, pCu2+ levels corresponding to a range of effects were identified based on graphical analysis. The level of cupric ion activity is expressed as the negative logarithm of the activity (i.e., pCu2+), similar to the way in which hydrogen ion activity is expressed as pH. Therefore, higher pCu2+ values indicate *lower* activity, and lower pCu2+ values indicate *higher* activity. Higher activity is associated with greater risk of toxicity.

Two benchmarks for vegetation risk were identified: a *de minimus* (i.e., negligible) effects level (DEL; pCu2+ > about 6 or 7) above which no ecologically significant adverse effects are expected, and a probable effects level (PEL; pCu2+ $\leq$5) below which the detection of adverse effects is considered probable. Adverse effects are possible for pCu2+ values between the DEL and PEL, but the ecological significance of such effects is less certain. The DEL and PEL are used in the H/WCIU ERA to characterize potential risks to the terrestrial plant community.

<u>Terrestrial Wildlife</u>

A detailed assessment of risks for all terrestrial wildlife receptors was provided in the site-wide BERA. The conclusions drawn indicate that risks to wildlife receptors appear to be relatively restricted to the most contaminated areas of the site immediately east of the smelter and northernmost tailings impoundments (within the S/TSIU) and at some locations along the Hanover and Whitewater Creek corridor (within the H/WCIU). Risks to individual ground-feeding birds appeared to be of potentially greatest concern based on risk from copper intake from ingested soils and food as well as cumulative risk from intake of other COPCs. Risk to small mammals was of second-greatest concern, but was substantially less than that estimated for ground-feeding birds. Individuals of larger and more mobile receptors such as ruminants, mammalian predators and raptors appeared to be at relatively low risk. Overall, the site-wide BERA indicates that local populations inhabiting the AOC or within sub-areas of the AOC could be affected in localized areas. No effects to regional populations of wildlife were predicted primarily because of the extensive areas adjacent to the site that provide similar habitat.

The site-wide BERA provided a range of soil screening levels (SSLs) for use in assessing copper risk to the small ground-feeding bird receptor. These values are utilized in the H/WCIU document. In addition, H/WCIU risk estimates are provided for all COPCs evaluated in the receptor-specific detailed analysis portion of the site-wide BERA. The exposure models and toxicity reference values (TRVs) used in the site-wide BERA are unchanged in this risk assessment.

<u>Aquatic Life</u>

Only preliminary surface water and sediment data were available for use in the site-wide BERA. The report generally concluded that potential risks from cadmium, copper, lead and zinc were predicted along the Whitewater Creek corridor and in Bolton Draw. However, it was noted that the habitat in these areas was highly limited, indicating that aquatic populations are also likely limited by the quality of aquatic habitat available.

Additional data were collected as part of the Phase II H/WCIU RI in order to address deficiencies in the spatial coverage of surface water and sediment data within Hanover Creek, Whitewater Creek, and several of the tributaries associated with Whitewater Creek. These data are used in this report to further characterize the potential for aquatic risk within the H/WCIU.

1.1.5 COPCs Evaluated in the H/WCIU ERA

The site-wide BERA identified a list of COPCs that were assessed for each of the three main assessment categories of endpoints. These chemicals were identified as COPCs in the site-wide BERA via the screening-level risk assessment process that conservatively compared upper-bound concentrations to risk-based toxicity values. The COPCs evaluated in the site-wide BERA are listed below and constitute the list of COPCs that were also evaluated in the H/WCIU ERA:

Vegetation

- Copper
- Hydrogen ion activity (pH)

Terrestrial Wildlife

- Cadmium

- Chromium
- Copper
- Lead
- Molybdenum
- Selenium
- Zinc

Aquatic Receptors

- Cadmium
- Copper
- Lead
- Zinc

1.1.6 Data Available for Use in the S/TSIU ERA

Data specific to the H/WCIU were collected or reviewed as part of the BRI (1995), H/WCIU RI (Golder 2000), the Ecological RI (Arcadis JSA 2001), the sediment background investigation (Golder 2004), and recent data collected specifically to fill data gaps related to the H/WCIU ERA (Golder 2002, Golder 2003, Golder 2007, Golder 2008). The most recent RI dataset (Golder 2008) was collected based on data needs identified for characterizing the nature and extent of contamination for the ERA. The primary ERA data needs were identified to (1) fill spatial data gaps for soil/sediment in the H/WCIU, particularly in overbanks in Hanover Creek, (2) obtain tissue samples (seeds, foliage and invertebrate) in H/WCIU overbank areas, and (3) obtain additional water samples from streams and tanks (i.e., stock ponds). The ERA risk analysis includes all historical data evaluated in the BERA, and the data collected as part of the H/WCIU RI.

Data from 99 shallow soil (0 – 6” bgs), 112 shallow sediment (0 - 6” bgs), 29 surface water, 14 above-ground foliage, 5 seed head, and 13 terrestrial invertebrate samples were used to prepare the H/WCIU ERA (Figures 1.1-3 through 1.1-13; Figures 3.4-1 through 3.4-7). The soils data from the less than 2000 µm size fraction were applicable for use in the ERA and are consistent with methodologies used in the site-wide BERA. The smaller size fraction sampled for the human health soil samples as part of the Phase I and Phase II RIs represent the size fraction that would be most likely to adhere to human skin. While dermal exposure to wildlife receptors may be a pathway of exposure, it is generally considered to be of lower concern than ingestion pathways evaluated quantitatively in the site-wide BERA. Soil samples from the larger size fraction are more likely to represent the exposure that wildlife receptors may be exposed to when grazing, browsing, or burrowing.

The following outline provides an overview of the samples used in the H/WCIU ERA. Samples were collected from various investigations within the IU between 1995 and 2008. Unless otherwise noted, soil and sediment samples were collected from the 0 to 6 inch bgs depth interval and sieved to include the less than 2000 µm size fraction. At each summer rainfall pool location, samples were collected for 1) evaluation of the total metals fraction and 2) evaluation of the dissolved metals fraction after filtration at 0.45 µm.

- Hydrogeologic Investigation of Lower Whitewater Creek (1995)

  Three sediment samples were collected from Lower Whitewater Creek active channel areas from the 0 to 12 inches bgs depth interval.

- Background Remedial Investigation Report (1995)

  Twenty-two sediment samples were collected from active channel areas; five sediment samples were collected from tributaries; one soil sample was collected from an overbank; six composite soil samples were collected from yards; and eight soil samples were collected from tin can operations.

- Phase I RI-2000

  Twenty-five sediment samples were collected from active channels; 21 sediment samples were collected from tributaries; 51 soil samples were collected from bars and overbanks; four soil samples were collected from terraces. Analytical results were obtained for soil/sediment in the less than 250 µm and 250-2000 µm size fractions. A mass-weighted average was calculated for the less than 2000 µm fraction using the results from the other two fractions. Eleven summer rainfall pool samples were also collected as part of the Phase I RI.

  Eleven samples (seven sediment and four soil) were collected following a tailings spill event in November of 1999 from the same locations where the Phase I RI samples had been collected. These samples were collected and analyzed following the same procedures as the Phase I RI samples, and the data were used in place of the pre-tailings spill samples (Golder 2000).

- Ecological RI (Arcadis JSA 2001)

  Nine soil samples were collected from overbanks of ephemeral drainages within the H/WCIU for use in the ERA.

- Technical Memorandum: Investigation of the Side Channel on Lower Whitewater Creek (Golder 2002)

  Nine Channel Transect Composite sediment samples were collected from the Side Channel in November/December 2001. A subset of three sediment samples were subject to a modified Synthetic Precipitation Leaching Procedure (SPLP) and water soluble metals data were generated.

- Technical Memorandum: Supplemental Investigation of Lower Whitewater Creek (Golder 2003)

  Twenty-seven channel transect composite samples were collected from Lower Whitewater Creek in June 2003. Six soil samples were collected from upland areas; five soil samples were collected from overbanks; and 16 sediment samples were collected from active channel areas. A subset of nine samples was subjected to a modified SPLP and water soluble metals data were generated.

- Technical Memorandum: Summer Rainfall Pool Sampling (Golder 2007)

  Ten samples were collected from summer rainfall pools throughout the H/WCIU in September 2006.

- Technical Memorandum: Data to Support Ecological Risk Assessment (Golder 2008)

  In September 2007, nine soil samples were collected from overbanks and vegetated bars, and six channel transect composite sediment samples were collected from active channel areas. A subset of six active channel sediment samples were subject to a modified SPLP and water soluble metals data was generated. Eight summer rainfall pool samples were also collected.

  NewFields collected composite biota samples from 13 locations in the H/WCIU in September and October 2007. Fourteen above-ground foliage (one sample was collected inadvertently), five seed head, and 13 terrestrial invertebrate samples were collected. In addition, NewFields collected five sediment grab samples from a visually impacted area of Lower Whitewater Creek.

The local sources of contamination, transport pathways, and physical features differ along the H/WCIU therefore, all discussions of data within the H/WCIU are presented by physical reaches as identified by Golder (2000, 2004). Because the physical reaches were not originally identified based on ecological exposure, several have been combined and several additional assessment areas have been defined. Data were grouped as follows:

Physical Reach 1 – Hanover Creek

Physical Reach 2 – Whitewater Creek upstream of Hanover Creek to Bayard

Physical Reach 3 – Whitewater Creek from Bayard to Hurley

Bayard Canyon – Samples collected within Bayard Canyon

Physical Reach 4 and 5 – Whitewater Creek from Hurley to downstream of TP-1

Physical Reach 6 and 7 – Whitewater Creek from TP-1 to TP-7

Physical Reach 8 and 9 – Whitewater Creek from TP-7 to Downstream of Highway 180

Side Channel – Whitewater Creek side channel area south of TP-7

Lower Whitewater – Whitewater Creek south of Highway 180 to near the San Vicente Arroyo

All available soil/sediment and surface water sample locations are shown in Figures 1.1-3 through 1.1-13.

The data resulting from the H/WCIU sampling are presented in Appendix A (Tables A-1 through A-6). As noted above, data from the Eco RI (within the boundaries of the S/TSIU) are also included in this assessment as well as samples from the Background Sediment Investigation (Golder 2004).

1.2 Organization of the H/WCIU ERA Report

The H/WCIU ERA report is organized by groups of assessment endpoints. The ERA relies heavily on detailed problem formulation presentations provided in the site-wide BERA and TM-1 while focusing on the results of the H/WCIU RI sampling and the assessment of ecological risk in light of the greater resolution provided by the additional data. Risk analysis is grouped by assessment endpoint as follows:

Section 2: Risk Analysis for Vegetation in the H/WCIU

Section 3: Risk Analysis for Wildlife in the H/WCIU

Section 4: Risk Analysis for Amphibians and Aquatic Receptors in the H/WCIU

Section 5: Conclusions and Recommendations

2.0 RISK ANALYSIS FOR VEGETATION IN THE H/WCIU

This section presents the H/WCIU risk analysis for the terrestrial vegetation assessment endpoint. As discussed in the site-wide BERA, the primary contaminant sources in the H/WCIU are from fluvial transport of COPCs from source areas associated with historical mining operations as well as from smelter emissions and windblown tailings (Figure 1.1-2).

The ephemeral drainage locations sampled as part of the ERI (Arcadis JSA 2001) were all in areas classified as Fluvial Forest Shrubland alliance. However, the vegetation alliance bordering the ephemeral drainages is varied. Sites in portions of Whitewater Creek within the Smelter and Tailing IUs were largely bordered by Mesquite/Mixed Grama areas, whereas more northern locations (ERA-28, -29, -30, -34) were bordered by Alligator-Oak Woodland or Alligator-Oak /Grama Woodland communities. At most of the locations, trees and tall shrubs of the Fluvial Forest Shrubland alliance were mainly restricted to the drainage bottoms, and the boundaries with adjacent upland communities were not well delineated.

As described in the site-wide BERA and TM-1, the primary exposure pathway for terrestrial plants to COPCs in H/WCIU soil/sediment is through absorption or direct contact of roots with contaminated soils. The effects of site conditions on the mobility and bioavailability of COPCs in soils are important considerations in the risk assessment. The geochemical behavior of metals and inorganics following deposition onto soils and sediments greatly affects their mobility, speciation, and bioavailability. Important geochemical reactions occur in soils that strongly affect the speciation of metals and the ease with which they are assimilated by plants. Most important is the pH of the immediate environment, and secondarily is the concentration of dissolved ligands. At acidic pHs, most metals occur in solution as the free metal ion (e.g., Cu2+ or Pb2+). As pH increases, the free metal ion bonds with dissolved ligands to form charged and uncharged dissolved complexes of varying stability and bioavailability (e.g., $CuSO_4^o$, $CuHCO_3^+$, $CuCO_3^o$, Cu-organic). Stable complexes exhibit substantially lower bioavailability, and hence lower toxicity, than weak complexes or the free metal ion. Depending on the pH, the proportion of metal complexes may comprise a significant portion of the total metal load in a system. Consequently, the total content of metals in soil and water can be less important than the abundance of the speciation and bioavailable fraction present.

Other factors that affect speciation and mobility include the presence of iron, aluminum, and manganese oxyhydroxides, organic carbon content, and clay content. These phases act as strong sorbents that remove metals from solution and render them unavailable to biota. For example, copper forms strong complexes with organic carbon compounds and forms relatively insoluble carbonate or oxide compounds above a pH of 5.5. As such, copper may be largely bioavailable in acidic soils that are low in organic carbon, and unavailable in neutral pH, clayey soils rich in carbonate and organic matter.

In the presence of sufficient soil alkalinity (usually as calcium carbonate) typical of New Mexico soils, metals such as cadmium, lead, and zinc can be removed from solution as carbonate minerals, such as otavite ($CdCO_3$), cerussite ($PbCO_3$), or smithsonite ($ZnCO_3$). Other inorganic constituents such as the metalloids arsenic, selenium, and molybdenum tend to form negatively charged oxyanions in soil solutions (e.g., AsO_4^{2-}, SeO_4^{2-} and MoO_4^{2-}) that are relatively immobile when pHs are less than 7, but become mobile under slightly alkaline pH (pH>7). Most of the metal COPCs at the Chino Mine site are very susceptible to adsorption to aluminum, iron, and manganese oxy-hydroxide solids ("sesquioxides") in the soil zone. This is an extremely important removal mechanism because sesquioxides are abundant in New Mexico soils, and adsorption to these solids occurs even when COPC levels are below that required for metal precipitation.

Thus, metal bioavailability is dependent upon a complex combination of mineral content and pH of soils in affected areas. However, the overall most important factors for a given soil and contaminant type tends to be the total concentration and the pH. The vegetation risk analysis focused on these variables for assessing potential phytotoxicity and effects on vegetation.

2.1 Assessment Endpoint and Objective

The quality of vegetation within the ephemeral drainages, associated with H/WCIU, as wildlife habitat is the assessment endpoint addressed in this section (Table 1.1-1). Vegetation is critical as a food source and as physical habitat for wildlife. Various plant species have been shown to be sensitive to various metals, including copper and acidic pH in soils by exhibiting toxic responses when exposed. Metal toxicity to vegetation can alter the plant community composition and structure, which can result in decreased wildlife habitat and range quality. The assessment objective was to assess the risk that increased metal concentrations and depressed pH due to mine and mineral processing activities could affect adversely vegetation at the site.

2.1.1 Bioavailable Copper

Bioavailable copper (as pCu2+) appeared to be the best predictor of potential phytotoxicity in the site-wide BERA. The predicted pCu2+ in each of the H/WCIU channel bar or overbank sediment samples was calculated using the 2-variable (pH and total copper) model for ephemeral drainages (Table 1.1-3). Predicted pCu2+ values are presented in Table 2.2-1.

Cupric ion activity is predicted to be less than 7 (the upper level of the DEL) in 55 of 109 total H/WCIU surface soil samples (<2000 µm) collected from bar and overbank locations throughout the IU. Values greater than 7 indicate a lack of potential toxicity, while values less than 7 indicate increasing potential for toxicity. The presence of values less than 7 indicates that the potential for risks to terrestrial vegetation cannot be discounted in the H/WCIU.

The predicted pCu2+ was within the range of the DEL (range of 6 to 7) in 19 samples while an additional 5 samples were between the minimum DEL (6) and the PEL (5). The potential for effects in this range is unknown but should be considered to be greater than those soils with pCu2+ greater than 7. Finally, 31 samples had pCu2+ values predicted to be less than the PEL. These areas represent the highest risk of adverse effects from copper and depressed pH, and some level of effects to community structure and/or plant growth is expected in these areas. As shown in Figures 2.2-1 through 2.2-8, pCu2+ values are predicted to be lowest in Physical Reaches 3 through 8 in Whitewater Creek from Bayard southward to the southern end of the tailings impoundments.

Within Physical Reach 1 (n = 14), no samples had pCu2+ values less than the PEL (Figure 2.2-1). One sample was between the minimum DEL and PEL and two samples were between the upper and lower DELs. Within Physical Reach 2 two of the three samples were between the upper and lower DELs (Figure 2.2-2).

Physical Reach 3 was the most heavily sampled area of the H/WCIU. The pCu2+ was estimated for 34 total samples. Of those samples, 12 had estimated pCu2+ values less than the PEL, two were between the minimum DEL and the PEL and six were between the upper and lower DELs. These samples are shown on Figure 2.2-3. The lowest pCu2+ values within the reach were calculated in the downstream portions of the reach where the majority of samples had predicted pCu2+ values less than the PEL and as low as 3.10 (U03-2316).

All of the samples within Physical Reach 5 had pCu2+ values less than the PEL, including those from locations ERA-23 and ERA-26 that were directly measured rather than estimated (Figure 2.2-4). The single sample within Physical Reach 4 had a predicted pCu2+ value greater than the DEL.

All of the samples (n = 6) within Physical Reach 6 also were less the DEL with five of the six less than the PEL and one between the upper and lower DELs (Figure 2.2-5).

No samples were available from Physical Reach 7. Each of the 3 samples within Physical Reach 8 was less than the upper DEL. Two samples were between the upper and lower DELs and one sample was lower than the PEL (Figure 2.2-5).

In Physical Reach 9, only one of the six samples had an estimated pCu2+ less than the DEL. Sample U03-3902 had an estimated pCu2+ equal to 5.36, greater than the PEL but less than the minimum DEL (Figure 2.2-6).

Finally, within the Whitewater Creek Side Channel and Lower Whitewater Creek, the majority of samples had estimated pCu2+ values lower than the DEL (Figures 2.2-7 and 2.2-8). In the Side Channel, five of the ten samples had estimated pCu2+ values less than the PEL, and one between the upper and lower DELs. The remaining five samples had estimated pCu2+ values greater than the DEL.

In Lower Whitewater Creek, five of 27 samples had estimated pCu2+ values less than the PEL, two between the PEL and minimum DEL, and six between the upper and lower DELs. As shown on Figure 2.2-7, all of the samples that had estimated pCu2+ values less than the DEL were observed within a large area nearly devoid of vegetation or in one of two areas downstream.

2.2 Community Metric and Laboratory Phytotoxicity Testing

Results of the community assessment and laboratory phytotoxicity testing were presented in detail in the site-wide BERA. No additional data for either of these two measures were collected as part of the H/WCIU RI. The results of community and laboratory testing as they relate to the H/WCIU are summarized in this section.

Statistical analyses indicated significant differences among phytotoxicity test endpoints of perennial ryegrass and alfalfa grown in site soils compared to both reference area soils and laboratory control soils. There were also significant differences in toxicity endpoints among H/WCIU locations, which were correlated with bioavailable copper concentrations predicted by pCu2+ calculations (see ERA Table 2.2-3). Significantly reduced seedling emergence and survival were noted at ERA-26 and ERA-29 (alfalfa emergence only). Emergence was zero at ERA-26 which is located to the east of the tailings impoundments and had moderately elevated copper but very low pH.

No statistical analyses were presented for the vegetation community endpoints evaluated as part of the site-wide BERA due to a lack of suitable reference areas for the samples collected in the ephemeral areas of H/WCIU. The field assessment data from the ephemeral drainages do, however, indicate effects to the vegetation community that were correlated with bioavailable copper levels. Only a total of four species were noted at ERA-26 versus an average of 33 species at the remaining ephemeral drainage locations. In addition, total canopy cover at that location was estimated at 29 percent versus an average of 63 percent site-wide in ephemeral drainages. Similar differences in species richness and canopy cover were not, however, noted at ERA-23 which had a similar pCu2+ although the woody species noted at ERA-23 may be more tolerant to toxicity from metals than herbaceous species. Locations ERA-23 and ERA-26 were the only two ERI sample locations within the H/WCIU that had pCu2+ values less than the PEL and both were different in either species composition or species richness and cover than the remaining ERI ephemeral drainage sample locations.

2.3 Conclusions for Terrestrial Vegetation

The conclusions regarding risk to the vegetation assessment endpoint remain unchanged from the site-wide BERA. Copper (and other metals) concentrations are elevated above the background range identified for the H/W Creek corridor (UCL95 = 183 mg/Kg; Golder 2004) in most of the overbank and vegetated bar sampling locations. Soil pH is also depressed in many areas, particularly downstream of Bayard. Toxicity testing conducted for the BERA showed phytotoxicity to laboratory test species in areas with elevated copper and/or depressed pH. Multiple areas with pCu2+ levels below the PEL lack vegetative cover and if vegetation exists, it is dominated by one species (e.g., ERA-26 and Lower Whitewater Creek stations U03-11254, U03-11255, U03-11256).

As noted in the BERA, an adequate reference area for the ephemeral drainage vegetation community was not identified, so quantitative impacts based on field measurements were not assessed. However, data from the BERA indicate that phytotoxicity test endpoints, and field measurements of species richness were correlated with pCu2+. The disturbance and land-use history of the various vegetated bars and overbanks was highly variable, as was the apparent vegetation community. Thus, impacts to vegetation community from chemical impacts are likely for areas with elevated copper and depressed pH. In addition, locations along Hanover Creek may be subject to vegetation risk from cadmium, zinc, and lead.

To extrapolate results from the site-wide BERA to locations not included in the ERA analysis, the PEL and DEL levels based on pCu2+ were used. Figures 2.2-1 through 2.2-8 show locations with pCu2+ levels below the PEL (pCu2+ < 7) where the risk of vegetation impact is greatest. A substantial proportion of the locations in Physical Reaches 3, 5, 6, as well as the Side Channel breakout area and the Lower Whitewater Creek areas were associated with soil pCu2+ less than the PEL. In some of these areas, especially ERA-26 and Lower Whitewater Creek, the wildlife habitat quality is likely to be adversely affected based on the lack of vegetation. However, without a reference area and quantitative evaluation of habitat quality at other locations, the loss of wildlife habitat function cannot be quantified.

A detailed discussion of the uncertainties in the terrestrial vegetation analysis is provided in the site-wide BERA. The discussion included in that document is directly applicable to this analysis. In addition, the lack of community-level or laboratory phytotoxicity data at the soil sampling locations collected within the H/WCIU introduces additional uncertainties into the analysis. However, it is expected that these uncertainties affect the conclusions to a small degree given the high level of predictive ability of the pCu2+ model and the correlations between pCu2+ and phytotoxic effects. Additional community and/or laboratory phytotoxicity data from the H/WCIU could decrease the level of uncertainty in the extrapolation of results from the ERA to the H/WCIU RI. In addition, confirmation data could also be collected to verify the predictive ability of the pCu2+ model within the ephemeral drainages at the site. These additional data would also serve to reduce the uncertainty in this analysis.

3.0 RISK ANALYSIS FOR TERRESTRIAL WILDLIFE IN THE H/WCIU

This section provides additional risk analysis for terrestrial wildlife in order to supplement the analyses conducted as part of the site-wide BERA (NewFields 2005). As noted previously, Phase 2 RI data on the nature and extent of contamination provide data in areas of the H/WCIU that were not available for the site-wide BERA. In addition, vegetation and invertebrate tissue samples were collected at RI soil sampling locations to provide better spatial coverage for the exposure analysis provided in the site-wide BERA.

The site-wide BERA concluded that potentially unacceptable risk was observed for a small ground-feeding bird receptor, primarily due to elevated copper concentrations in soil, vegetation and invertebrates. The BERA also indicated risks from several other COPCs in the H/WCIU in areas upgradient of the former smelter location. Unacceptable risks to regional populations of wildlife were not predicted for any receptor, and localized populations of large and mobile receptors (e.g. ruminants and mammalian/avian predators) were low.

For these reasons, the risk assessment in this document focuses on the small ground-feeding bird receptor and the deer mouse receptor. Both of these species are important receptors as they form the basis of the food chain as prey items and are good indicators for potential risk since they live in close contact with potentially contaminated soils and feed mainly on species that are potentially the most contaminated food items in the H/WCIU (i.e., terrestrial invertebrates and plants).

The ecotoxicologically based soil screening levels (SSLs) generated in the site-wide BERA are used as the primary tool for evaluate risks for the H/WCIU in this document. As in the site-wide BERA, SSLs corresponding to varying assumptions about bioavailability and toxicity endpoints are used. In addition, new data on metal concentrations in vegetation and invertebrates are used to generate exposure analyses for areas not evaluated previously, including the Side Channel Breakout Area and Lower Whitewater Creek areas that were not sampled in the ERA field program.

3.1 Exposure Point Concentrations

For comparison of soils concentrations to SSLs, statistics to represent exposure point concentrations (EPCs) were calculated using two software packages. The 95th percentile EPC, as used in the site-wide BERA, was calculated using Number Cruncher Statistical Systems (NCSS 2004) while a 95th upper confidence limit (UCL) on the mean was calculated using ProUCL (USEPA 2007). Summary statistics calculated using only data from the H/WCIU surface soils (0 – 6”, <2000 µm), overbank sediments and channel bar sediments for the seven COPCs that were addressed under the detailed risk characterization portion of the site-wide

BERA are presented in Table 3.1-1. Table 3.1-1 presents statistics both on for the entire IU and for each grouping of data by Physical Reach as discussed in Section 1.1.6.

3.2 Comparison to Copper Soil Screening Levels

The site-wide BERA provided SSLs for copper in order to provide a tool to identify potential risks to the small ground-feeding bird. No copper SSLs were provided for other receptors since the small ground-feeding bird was shown to be the most sensitive receptor to copper and SSLs calculated for this receptor would be protective of all other receptors.

A series of SSLs were calculated for the No Observed Adverse Effects Level (NOAEL) and Lowest Observed Adverse Effects Level (LOAEL) based TRVs based on HQs from 1 to 100, and bioavailability assumptions of 10 to 100%. The range of SSLs calculated in the site-wide BERA is provided in Table 3.2-1. In Table 3.2.-1, bioavailability is represented as absorption factor (AF). HQs exceeding 1 indicate that the predicted rate of exposure is greater than the rate of exposure represented by the TRV. If the TRV is a NOAEL, indicating exposures below which effects are not expected, then HQs greater than 1 indicate that risk cannot be dismissed as *de minimus,* but do not necessarily indicate unacceptable risk. HQs greater than 1 using a LOAEL TRV indicate that there is a potential for a risk based on the toxicological endpoint associated with the TRV. In general, the higher the HQ, the greater likelihood of adverse effects and the greater the potential magnitude of effects.

Since copper may be tightly bound in the soil matrix in which they are found, the amount of copper that is passed through the digestive tract of the receptor and actually enters the bloodstream is likely to be lower than the total amount of copper ingested with the soil. The unabsorbed portion of the copper passes through the digestive system and is eliminated from the body. The absorbed portion of copper is estimated using the relative bioavailability. The actual bioavailability of copper is almost certainly less than 100%, but is unknown for this site. Therefore, for calculation of SSLs, a range of bioavailability from 10 to 100% was used.

The small ground-feeding bird was assumed to have a diet made up of 100% seeds. The median bioaccumulation factor (BAF) was used to estimate the seed concentration from the co-located soil concentration of copper (seed concentration = soil concentration X BAF). The copper SSLs were calculated using the median BAF, which represent the ratio of copper in food items versus co-located soil samples (BAF = 0.073). The median BAF was calculated from soil and food item data collected as part of the ERI (Arcadis JSA 2001).

The 95th percentile EPC for copper in the H/WCIU RI soil samples is equal to 1,446 mg/kg (Table 3.2-2). When compared to the NOAEL and LOAEL SSLs, the HQs are 7.5 and 5.0 respectively assuming 100% bioavailability from ingested soils. Using an assumption of 50% relative bioavailability from soils, the NOAEL and LOAEL HQs are 5.4 and 3.6, respectively.

HQs calculated using the median soil (i.e., 50th percentile) concentration equaled 2.3 and 1.5 for the NOAEL and LOAEL TRVs, respectively, assuming 100% relative soil bioavailability.

The 95th UCL was not used as an EPC in the site-wide BERA due to the non-random nature of sampling (NewFields 2005). However, data were collected using a more traditional approach for the H/WCIU RI which makes the 95th UCL an appropriate EPC for risk assessment purposes. The 95th UCL recommended by ProUCL (USEPA 2007) equaled 631 mg/kg and resulted in NOAEL and LOAEL HQs equal to 3.3 and 2.2, respectively, when assuming 100% relative bioavailability from soils, and 2.4 and 1.6 respectively when assuming 50% relative bioavailabilty from ingested soils. The results using the 95th UCL as the EPC are approximately equal to HQs calculated using the 75th percentile soil copper concentration. These results indicate a low to moderate level of potential risk to small ground-feeding birds in the H/WCIU. These results predict slightly higher risks than were predicted in the site-wide BERA, where the HQ calculated for the small ground feeding bird using the site-wide 95th percentile soil and seed concentrations was 3.5 when assuming 100% bioavailability from soils.

Figures 3.2-1 through 3.2-9 show the relative distribution of risk based on the HQs calculated for the small ground-feeding birds at S/TSIU RI sampling locations (soil samples only). The HQs were calculated using a LOAEL TRV and assuming 50% bioavailability from soils. Given the length of ephemeral drainages included in the H/WCIU and the number of potential source areas, estimates of exposure were also calculated by Physical Reach grouping as discussed in Section 1.1.5. Tables 3.2.3 through 3.2.9 present the HQs for each Physical Reach.

The 95th UCL and 95th percentile soil copper concentrations within each of the Physical Reaches or Physical Reach groupings had HQs greater than or equal to (Side Channel) 1.0 using the LOAEL TRV and assuming 100% soil bioavailability. Copper concentrations were highest within Physical Reach 3 where the 95th UCL (956 mg/kg) HQ calculated using the LOAEL TRV and assuming 50% soil bioavailability was equal to 2.4 (Table 3.2-4).

Available data within Physical Reaches 2, 4 and 5 were insufficient to calculate a 95th UCL or 95th percentile. Maximum detected concentrations within those Physical Reaches were equal to or greater than the 95th UCL observed in Physical Reach 3. All available samples within Physical Reaches 2, 4 and 5 (Figures 3.2-2 and 3.2-4) had copper concentrations exceeding the SSL calculated using the LOAEL TRV and assuming 50% soil bioavailability (402 mg/kg).

3.3 Additional COPCs

On a site-wide basis significant risks to any receptors from any COPCs other than copper were predicted in the site-wide BERA. For that reason, no additional SSLs were calculated in the site-wide BERA. Table 3.1-1 presents a comparison of the 95th percentile concentrations of each of the seven COPCs (upland soils only) discussed in the detailed risk analysis of the site-wide BERA to the H/WCIU RI-specific soil samples.

For the entire set of H/WCIU soil samples, the 95th percentile concentrations of cadmium, chromium, lead and zinc were all significantly higher than the 95th percentile concentrations evaluated as part of the site-wide BERA. This indicates that the risk characterization in the site-wide BERA is not an adequate representation of risks for the wildlife receptors inhabiting the riparian areas of the H/WCIU. The site-wide BERA exposure model was, therefore, used to calculate SSLs for cadmium, chromium, lead and zinc (Table 3.3-1) for comparison to H/WCIU soil data. The SSLs were calculated using LOAEL TRVs and the soil bioavailability factors discussed in the site-wide BERA. Food tissue COPC concentrations were calculated using the median BAFs identified using ERI data. Full details regarding the model are provided in the site-wide BERA Appendix G.

Concentrations of molybdenum and selenium in H/WCIU soils were not greater than those evaluated in the site-wide BERA and, therefore, pose no significant risk as concluded in the site-wide BERA.

3.3.1 Cadmium

The 95th percentile concentration of cadmium within H/WCIU soils was equal to 5.82 mg/kg versus the 3.22 mg/kg calculated site-wide in the BERA. The 95th percentile soil concentrations in Physical Reaches 1 (11.5 mg/kg), 2 (maximum = 19.1 mg/kg) and 3 (5.26 mg/kg) exceeded that 95th percentile for the site-wide BERA. Maximum or 95th percentile soil concentrations within all other areas were less than calculated for the site-wide BERA and, therefore, are predicted to be of similarly low risk for unacceptable effects to the wildlife inhabiting those areas.

Concentrations were highest within Physical Reaches 1 and 2 and are expected to be associated with historic lead/silver/zinc mines and mineral processing activities both upstream of and within those reaches (e.g., Groundhog Mine and Blackhawk Tailings). Cadmium concentrations, however, exceeded only the NOAEL SSL for the small-ground-feeding bird receptor (10.6 mg/kg) within Physical Reaches 1 and 2. The NOAEL SSL for the small mammal receptor nor the LOAEL for the small ground-feeding bird receptor were exceeded in any sample.

3.3.2 Chromium

The 95th percentile soil concentration of chromium in H/WCIU soils was slightly greater than the 95th percentile of upland soils concentrations discussed in the site-wide BERA. Upper-bound concentrations within Physical Reaches 2, 3, 8 and 9, lower Whitewater Creek and in the Side Channel were greater than the site-wide BERA concentration. Maximum and 95th percentile chromium concentrations within all other Physical Reaches were less than the site-wide BERA concentration.

Although elevated above those observed in the ERI dataset for the site-wide BERA, only the NOAEL SSL for the small ground-feeding bird (6.6 mg/kg) was exceeded and all samples are less than the USEPA's recommended EcoSSL of 26 mg/kg (USEPA 2007).

3.3.3 Lead

Upper bound soil lead concentrations within the H/WCIU (494 mg/kg) exceeded the 95th percentile soil concentration calculated in the site-wide BERA (40.9 mg/kg) by more than a factor of 10. Concentrations were highest within Physical Reaches 1, 2, and 3 and likely represent influence from upstream sources and/or from the former Groundhog mine at which remedial activities have been conducted (results of confirmation sampling are pending).

The 95th percentile concentrations within the three northernmost Physical Reaches were 1,470, 2,128 and 438 mg/kg respectively. Additionally, the single soil sample available from Bayard Canyon had a lead concentration of 551 mg/kg and the 95th percentile concentration within Lower Whitewater was equal to 83.6 mg/kg. All of these concentrations exceeded the LOAEL SSL calculated assuming 25% soil bioavailability as discussed in the site-wide BERA. Similarly, the 95th UCL of soil lead concentrations within Physical Reaches 1 and 3 also exceeded the LOAEL SSL (Physical Reach 2 did not have an adequate number of samples to calculate a UCL) indicating that the upper-bound estimate of mean soil lead concentrations is also greater than the LOAEL SSL. The LOAEL SSL was not exceeded by the 95th percentile soil lead concentrations in any other Physical Reach.

3.3.4 Zinc

Concentrations of zinc in soils within the H/WCIU also greatly exceeded those observed and assessed in the site-wide BERA. The 95th percentile of soil zinc concentrations in all H/WCIU samples (2,357 mg/kg) was 25 times higher than the 95th percentile concentration calculated and assessed in the site-wide BERA. Similar to lead, zinc concentrations are most highly elevated within Physical Reaches 1, 2 and 3 with 95th percentile concentrations equal to 4,637, 8,350 (maximum) and 1,722 mg/kg in those three reaches respectively and are greater than both the LOAEL SSL for the small ground-feeding bird receptor (282 mg/kg) and the small mammalian receptor (1,154 mg/kg).

The 95th percentile soil concentration in Lower Whitewater Creek also exceeded the LOAEL SSL for the small ground-feeding bird receptor, but the 95th UCL in that was less than the SSL. Maximum and 95th percentile soil zinc concentrations were lower than the small ground-feeding bird SSL in all other Physical Reaches.

3.4 H/WCIU Supplemental Biota Tissue Sampling Results and Additional Exposure Calculations

Tissue samples of vegetation, invertebrates, reptiles, birds, and small mammals were collected as part of the ERI and used in the site-wide BERA to assess risks to wildlife. Samples were collected from a few representative overbanks and bars adjacent to Hanover Creek for inclusion in the modified gradient sampling and risk analysis, but they were limited in spatial extent. To supplement the risk analysis for this H/WCIU ERA, vegetation and invertebrate tissue samples were collected from a subset of soil sampling locations in Hanover Creek (Physical Reach 1), Lower Whitewater Creek and in the Side Channel area.

The primary food items for the two most sensitive receptors, the small ground-feeding bird and the small mammal receptors, are assumed to be vegetation (both seeds and foliage) and terrestrial invertebrates. As a result, tissue sample collection was limited to those three tissue types. These samples were collected to augment the existing tissue database as well as to provide data from several areas within the IU that were not represented in the ERI data collection.

As discussed in the previous sections, SSLs were calculated using the median BAF from the ERI data. Statistical analyses were conducted in the site-wide BERA to attempt to fit the tissue data and soil data into a statistically significant regression equation. The data did not, however, fit a linear regression with adequate statistical power and as prescribed in the ERA workplans (TM-1 and TM-2). The median BAF was calculated for use in the back calculation of the SSLs. The use of a median BAF can lead to over- or under-estimation of tissue concentrations, particularly at concentrations significantly above or below the median soil concentration. At low concentrations, the median BAF may under-estimate tissue concentrations and may over-estimate them at high concentrations if the relationship between soil and tissue is non-linear. Table 3.4-1 presents the median BAFs calculated in the site-wide BERA. These were calculated using the data collected from all ERI sampling locations.

Because of the uncertainties related to using the median BAF values for estimating prey tissue concentrations, where tissue data were available risks were estimated using those data using the same risk model as the site-wide BERA for each location within the H/WCIU with soil and tissue data available (Tables 3.4-2 through 3.4-4). For those locations lacking seed data (lower Whitewater and the Side Channel area), foliage tissue concentrations were substituted for seed tissue concentrations. For areas where paired soil and tissue samples were not available, the average soil concentrations from nearby soil sample locations were used to represent the soil exposure portion of the HQ calculation. Drinking water was not included in the HQ calculations because it was an insignificant contributor to total exposure in the site-wide BERA, and was not available in the immediate vicinity most locations sampled in 2007. Tissue data collected in 2007 are shown in Figures 3.4-1 though 3.4-7.

HQs calculated from Physical Reach 1 confirm the presence of lead and zinc at concentrations that have the potential to cause unacceptable risk to wildlife receptors, particularly small ground-feeding birds that might utilize the riparian zones preferentially for feeding. Risks to wildlife in Physical Reach 1 from copper appear to be less significant than in downstream areas of the H/WCIU.

Tissue data suggest that risks to wildlife receptors from lead and zinc are lower in both Lower Whitewater Creek and in the Side Channel area, but that copper concentrations in soil and biota tissue in those areas may be elevated to a level that could cause unacceptable risk to wildlife.

A similar pattern was noted in the site-wide BERA and can be seen in Tables 3.4-2 through 3.4-4 where HQs greater than 1 using a LOAEL TRV are calculated for lead and zinc in the upstream portions of the H/WCIU and copper HQs greater than 1.0 predominate in the areas downstream of Bayard.

3.5 Terrestrial Wildlife Conclusions

Metal concentrations in overbanks and vegetated bars along the H/WCIU contain widely varying concentrations of metals. Areas of Hanover Creek and upper Whitewater Creek contained elevated concentrations of cadmium, lead, and zinc that correspond to potentially adverse effects on wildlife that intensively use the riparian area of these ephemeral drainages. More downstream segments of Whitewater Creek contain lower risks from these metals, but higher risk from copper. This analysis is reflected both in the comparison of site concentrations to SSLs, and the estimation of exposure based on biota sampled in 2007.

The SSLs developed in the site-wide BERA were the primary tool used to assess risk to wildlife receptors, with the risk analysis focused on copper. In several locations of the site, soil copper concentrations in overbanks and vegetated bars exceeded LOAEL-SSL for small ground-feeding birds. A relatively large proportion of these habitat locations sampled during the Phase I RI exceeded the LOAEL-SSL suggesting that birds inhabiting the drainages may be exposed to copper levels that exceed the LOAEL, especially species that are resident to these areas and/or nest there. No data on population size, nesting success or individual level effects are available for the site to confirm whether adverse effects are occurring. Some adverse effects on some individuals seem likely, but the overall effect on the assessment endpoint is unclear.

4.0 RISK ANALYSIS FOR AQUATIC RECEPTORS IN THE H/WCIU

Overall, aquatic habitat at the Chino Mine site is limited being dominated by ephemeral drainages, stock tanks, and a few natural springs. Despite its name, the H/WCIU also has limited permanent or long-term ephemeral habitats. Stormwater runoff forms temporary pools along the drainages that provide habitat for a limited number of species that are adapted to such conditions. Therefore, the data collection and risk analysis for H/WCIU focused on surface water and sediment conditions in these pools.

The site-wide BERA indicated that a potential for risks to aquatic receptors is present for aquatic biota in ephemeral pools along the Hanover and Whitewater corridors. The COPCs of most concern were cadmium, copper, lead, and zinc. In addition, intermittent pools in the H/WCIU also were predicted to have some potentially significant risks to aquatic receptors since they represent isolated potential breeding areas for amphibians and aquatic invertebrates. Sediment data were identified in the site-wide BERA as a data need for these areas.

4.1 Surface Water

The entire H/WCIU ERA surface water dataset is provided in Appendix A, Tables A-1 and A-2. Table 4.1-1 presents surface water data for cadmium, chromium, copper, lead, molybdenum, selenium and zinc compared to amphibian TRVs (Harfenist et al. 1989 and Schafer & Associates, 1999a) and acute and chronic New Mexico Water Quality Criteria (NMWQC) (20.6.4 NMAC). Aquatic habitat in the H/WCIU is predominantly composed of ephemeral sections of Hanover Creek, Bayard Canyon, Lucky Bill Canyon, Whitewater Creek, and the Side Channel area of Whitewater Creek south of the tailings impoundments. Several stock ponds are also present in Lower Whitewater Creek and represent a more permanent source of water and aquatic habitat than the ephemeral drainages. All sample locations are shown on Figures 4.1-1 through 4.1-3.

Both the chronic and acute NMWQCs apply to surface waters with a designated, existing or attainable use of “aquatic life” (i.e., permanent aquatic habitat). In cases where the designated use is defined as limited aquatic life, such as ephemeral conditions typical of the southwestern part of the state, only the acute NMWQCs may be applicable. For risk assessment purposes, comparisons to both acute and chronic criteria are used as screening values.

Dissolved cadmium was detected in 25 of 30 total samples. The amphibian no-effect TRV (0.004 mg/L) was exceeded in nine samples. The chronic NMWQC was exceeded in 22 samples, and the acute criterion was exceeded in five samples. Three of the five acute NMWQC exceedances were located between Physical Reaches 3 and 6. The two highest non-qualified results were detected at B-Ranch and Grunerud-1 (0.034 and 0.027 mg/L, respectively). These two locations also had the highest concentrations of dissolved copper and zinc.

Dissolved copper was detected in all summer rainfall pool samples. Upstream of the Lucky Bill/Bayard Canyon Confluence, sample WWC-38.1 exceeded both NMWQCs and the amphibian no-effect TRV (0.02 mg/L), and sample U03-9000 exceeded the chronic NMWQC. At all locations downstream of the Lucky Bill/Bayard Canyon Confluence, the amphibian no-effect TRV and chronic NMWQC standards were exceeded. Dissolved copper concentrations exceeded acute NMQWC at every sampling location beyond the Lucky Bill/Bayard Canyon Confluence with the exception of WWC-28.6 and the Rancher's Pond on Lower Whitewater Creek where only the chronic NMWQC was exceeded. The two highest copper concentrations were detected at locations Grunerud-1 (1.22 mg/L) and B-Ranch (2.34 mg/L) in Whitewater Creek upstream of Hurley, which also had the two lowest recorded pH values (4.6 and 4.2 SU, respectively).

The amphibian TRV is indicative of a no-effect level for successful metamorphosis in frogs (Porter and Hakanson 1976 as cited in Harfenist et al. 1989). Fort and Stover (1997 as cited in Pauli et al. 2000) observed abnormal limb development in frogs at copper concentrations above 0.5 mg/L. Dissolved copper was detected above 0.5 mg/L in five summer rainfall pool samples at two locations from the Phase I RI sampling event (U03-9302 and U03-9600) and at three locations from the Golder (2007) sampling event (B-Ranch, Grunerud-1, and LWWC-1). These results indicate a potential risk for adverse limb development in amphibians.

Dissolved lead was detected in 16 of 30 total samples. The chronic NMWQC was exceeded in one sample collected during the Phase I RI sampling event (U03-9001). Dissolved lead concentrations at three locations (B-Ranch, Grunerud-1, and U03-9001) exceeded the amphibian no-effect TRV (0.005 mg/L). The acute NMWQC was not exceeded in any sample.

Dissolved zinc was detected in 24 of 30 total samples. Results exceeded the amphibian no-effect TRV (0.2 mg/L) at 16 sampling locations and exceeded acute and chronic NMWQC at 14 sampling locations. Similar to dissolved copper results, dissolved zinc concentrations were highest at B-Ranch and Grunerud-1 (7.89 and 5.84 mg/L, respectively).

Total selenium was detected in 18 of 10 samples. No detected total selenium concentrations exceeded the acute or chronic NMWQCs, or the amphibian no-effect TRV.

Chromium was only detected in two samples, U03-9900 and B-Ranch, and the amphibian no-effect TRV (0.003 mg/L) was exceeded at sampling location U03-9900. No NMWQC were exceeded at either location. Detection limits exceeded the amphibian TRV at several locations.

4.2 Sediment

The entire H/WCIU sediment dataset is provided in Appendix A, Table A-3. Table 4.2-1 presents sediment data for cadmium, chromium, copper, lead, molybdenum, selenium, and zinc compared to the sediment TRVs used in the site-wide BERA. Cadmium, copper, lead, and zinc were selected for further analysis in the H/WCIU based on results of the site-wide BERA that indicated they were the primary aquatic COPCs of concern at the Chino site. Chromium, molybdenum, and selenium were included based on their presence as soil COPCs at the site. Figures 4.2-1 through 4.2-9 show the sediment data with comparisons to the sediment TRVs.

Two types of sediment TRVs were evaluated. The threshold effect concentration (TEC) represents the concentration below which no significant toxicological effects are expected, similar to the NOAEL TRV used for the wildlife endpoints. The probable effects concentration (PEC) represents a concentration above which significant effects are predicted. The PEC is generally analogous to the LOAEL TRV used for the wildlife endpoint.

Exceedances of the TEC were noted for cadmium (61 of 112 samples), copper (112 of 112 samples), lead (76 of 112 samples), and zinc (82 of 112 samples). Exceedances of the PEC were noted for cadmium (11 of 112 samples), copper (96 of 112 samples), lead (51 of 112 samples), and zinc (46 of 112 samples).

Risks from copper in sediments are elevated throughout the H/WCIU. Copper concentrations exceeded the TEC at every sampling location, and exceeded the PEC at 86% of the sampling locations.

Concentrations of copper in all physical reaches are significantly elevated over the available sediment benchmarks. Aquatic habitat quality in these highly ephemeral systems is, however, low due to ephemeral nature of the aquatic system.

Copper concentrations did not exceed the PEC in any of the sediment samples collected after the tailings spill event from the East Train pipeline into Whitewater Creek (August 1999). High flows associated with the spill event likely transported sediment downstream.

Molybdenum and selenium do not have available TEC or PEC benchmarks, nor benchmarks values analogous to the TEC and/or PEC. Benchmarks were available for chromium and all detected concentrations were less than both benchmarks.

4.3 Aquatic Life Conclusions

In most cases where surface water exists in the H/WCIU, copper concentrations are elevated over acute and chronic water quality criteria. Although the majority of the aquatic habitat is limited by ephemeral conditions, rainfall pool areas that may remain wetted for periods of time longer than when flow is present within the main channel in response to precipitation events represent potentially important aquatic habitat. Within the ephemeral areas of the H/WCIU, acute criteria likely represent the most applicable criteria for comparison purposes. In areas of more permanent water such as stock tanks and rancher's ponds that could support breeding sites for amphibians and aquatic invertebrates, chronic criteria and amphibian TRVs likely provide useful comparison tools.

Acute NMWQCs were exceeded in summer rainfall pools for cadmium, copper and zinc, indicating a potential risk to aquatic invertebrates or other aquatic life that may utilize the water when present. The quality of the habitat and the highly ephemeral nature of the drainages with each seasonal precipitation event, however, must be taken into consideration in any risk management decisions.

Risks to aquatic life from sediment exposure also appear to be significant within summer rainfall pools. Cadmium, copper, lead, and zinc concentrations exceeded sediment TRVs that are potentially predictive of adverse effects on sediment organisms, if water is present long enough for colonization by aquatic invertebrates. As with surface water, risk predictions for sediment should also be viewed in terms of quality of habitat and availability of water when making risk management decisions.

More permanent water bodies that are potentially affected include stock ponds along Whitewater Creek (LWWC Rancher's Pond and U03-9301). The amphibian TRV and chronic criteria for copper were exceeded at the more permanent water bodies sampled, indicating potential risk to aquatic life at these locations.

Consideration of future conditions may also be important in assessing risk to aquatic receptors. For example, potential flow from Whitewater Creek has been diverted eastward into the Bolton Draw drainage via a large excavation. Currently, flow in Hanover and Whitewater Creeks is ephemeral for most of the length in the H/WCIU. However, if conditions change such that flow is increased, residual salts in sediments may be solubilized and made more available to aquatic life. Such conditions could result if waste water from domestic water treatment or industrial use is discharged to Whitewater Creek above the diversion.

4.4 Uncertainties

Uncertainty is an inherent part of risk assessment. The site-wide BERA presented a comprehensive evaluation of the uncertainties specific to the site-wide BERA. The sources of uncertainty discussed in the site-wide BERA included:

- Sampling uncertainty and dap gaps (i.e., uncertainty about spatial distribution of contamination as a consequence of limitations in sampling a site).

- Uncertainty in the selection of COPCs.

- Uncertainty in the natural (seasonal and/or annual) variability in the species, populations, communities, and ecosystems in question, as well as uncertainty regarding individual sensitivity to COPCs.

- Uncertainty in risk characterization using laboratory-based toxicity values and the HQ approach.

- Uncertainty in models and parameters used to estimate risk potentials.

- Uncertainty in assessing background COPC concentrations that may relate to calculated risk potentials.

A thorough discussion of these uncertainties is provided in the site-wide BERA and all apply to the risk assessment for the H/WCIU.

In general the site-wide BERA presented a conservative determination of COPCs and a less conservative risk characterization that provided ranges of potential risks for use in making risk management decisions. Site-wide COPCs were selected based on a conservative screening approach that minimized the potential for Type I error, or the potential for not selecting chemicals that are potential risk drivers as COPCs. This approach allows similar limitations of Type I error within the H/WCIU since the COPCs from the site-wide BERA were carried into this risk assessment.

Risk-based conclusions were reached in the site-wide BERA based on potential ranges of risk to the assessment endpoints. Similarly, this risk assessment used the conclusions reached in the site-wide BERA to assess potential risks within the H/WCIU. Conditions in the H/WCIU were reviewed in terms of the conditions that were discussed as potential risk drivers in the site-wide BERA. This approach assumes similar uncertainties in the H/WCIU assessment as those that were identified and discussed in the site-wide BERA.

There are additional uncertainties related to each assessment endpoint that require further discussion. For the vegetation community assessment endpoint, risk-based models using pCu^{2+} in soils to predict community-level effects are a significant source of uncertainty. Although the site-wide BERA showed strong correlations between pCu^{2+} in surface soils and community-level vegetation effects such as canopy cover and species richness, models designed to approximate reality are inherently uncertain. While it is unclear whether the pCu^{2+} over- or under-estimates the potential for community-level effects on the site vegetation, this source of uncertainty should be considered in risk management decisions for the site.

Similarly, for the small ground-feeding bird, risks were assessed within the narrow band of riparian areas potentially affected by water flowing in Whitewater Creek and in areas where sediments were deposited following high-flow conditions. The model used for the assessment assumed that the receptors focus all of their activities, including all feeding, to this narrow corridor. The assessment endpoint for wildlife receptors is based on effects to populations of receptors. It is uncertain whether a viable population of small ground-feeding birds inhabits the areas associated with elevated COPC concentrations or whether local populations utilize the riparian areas more frequently than more upland areas. It is likely that receptor populations utilize both the riparian areas and the surrounding upland areas, but the proportion of habitat use within each of the areas is unknown.

Finally, for the aquatic receptors endpoint, very limited data regarding habitat quality and aquatic community presence and structure is available. While there are clearly concentrations of COPCs in surface water and sediment within the H/WCIU that could have deleterious effects to the aquatic community, the current presence or health of the community is not known. This uncertainty should also be considered by risk managers when determining a risk-based course of action for the H/WCIU.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The results of the analysis performed above are consistent with the analysis contained in the site-wide BERA. Elevated concentrations and increased risk from cadmium, lead, and zinc appear to be related to sources in the Hanover Creek reach extending from the confluence with Whitewater Creek upstream to the AOC boundary, and to the Groundhog Mine area affecting the upper Whitewater Creek and Bayard Canyon. Copper is the primary source of risk in more downstream areas, particularly downstream of Bayard on Whitewater Creek and areas of Bolton Draw into which Whitewater Creek has been diverted. Substantially elevated copper concentrations and depressed pH are observed throughout Whitewater Creek, extending to the Lower Whitewater Creek segments that are south of the main Chino Mine Site and tailing pond areas.

Wildlife habitat quality throughout the Hanover Creek and Whitewater Creek downstream to Hurley is impacted by both physical and chemical stressors. Physical disturbance due to construction, tailing removals, and flooding seems to have affected extensive areas in active channel and bar areas as well as the overbanks and terraces where much of the vegetation associated with the ephemeral drainage occurs. Vegetated areas on overbanks and bars that were the focus of the ERA analysis contained elevated concentrations of cadmium, copper, lead, and zinc that could result in toxicity to vegetation and exposure of wildlife receptors to concentrations that exceed LOAEL benchmarks. However, it is unclear to what extent toxicity has contributed to decrease in wildlife habitat quality under baseline conditions.

Aquatic habitat in the H/WCIU is primarily limited due to lack of persistent water sources. However, metal concentrations and low pH in water and sediment result in potentially toxic conditions in ephemeral pools and during seasonal flows, as evidenced by exceedance of New Mexico acute water quality criteria and exceedance of sediment PECs in some locations. Direct measure of toxicity of water or sediment was not conducted, nor was quantitative characterization of aquatic communities in permanent or temporary water bodies. Sediment and water toxicity tests with appropriate test species could be conducted to reduce uncertainty, but it is unclear whether results would alter risk management decisions. Quantitative characterization of aquatic communities in temporary water bodies is likely to be associated with substantial variability due to habitat differences and is unlikely to be a useful tool in determining the extent of toxic effects on aquatic fauna.

6.0 REFERENCES

Arcadis JSA. 2001. Administrative Order on Consent, Draft Phase II RI report for the Ecological IU. May, 2001.

CMC. 1995. Administrative Order on Consent, Investigation Area Remedial Investigation Background Report, Chino Mine Investigation Area. October.

Golder (Golder & Associates, Inc.). 2000. Hanover and Whitewater Creeks Phase I Remedial Investigation Report, Chino Mine Investigation Area.

Golder (Golder & Associates, Inc.). 2002. Technical Memorandum, Investigation of Side Channel on Lower Whitewater Creek, Hanover and Whitewater Creeks Investigation Units. March.

Golder (Golder & Associates, Inc.). 2003. Technical Memorandum, Supplemental Investigation of Lower Whitewater Creek, Hanover/Whitewater Creeks Investigation Units. October.

Golder (Golder & Associates, Inc.). 2004. Supplemental Technical Memorandum, Sediment Background Investigation, Hanover and Whitewater Creeks Investigation Units. April.

Golder (Golder & Associates, Inc.). 2007. Technical Memorandum, Summer Rainfall Pool Sampling, Hanover/Whitewater Creeks Investigation Units. July.

Golder (Golder & Associates, Inc.). 2008. Technical Memorandum, Data to Support Ecological Risk Assessment, Hanover/Whitewater Creeks Investigation Units. February.

Harfenist, A., T. Power, K.L. Clark, and D.B. Peakall. 1989. A review and evaluation of the amphibian toxicological literature. Can. Widl. Serv. Tech. Rep. Ser. No. 61, Ottawa. 222 pp.

NewFields. 2005. Chino Mines Administrative Order on Consent. Site-wide Ecological Risk Assessment. February.

NMED (New Mexico Environment Department). 1995. Personal communication to Tom L. Shelley (Chino Mines Company) from James McDonald (NMED). December 27.

NCSS (NCSS 2000 Statistical System). 2004. User’s Guide.

Pauli, B.D., J.A. Perrault, and S.L. Money. 2000. RATL: A Database of Reptile and Amphibian Toxicology Literature. Technical Report Series No. 357. Canadian Wildlife Service, Headquarters, Hull, Quebec, Canada.

Schafer (Schafer & Associates). 1999a. Chino Mines Administrative Order on Consent Site-wide Ecological Risk Assessment Technical Memorandum No. 1 (TM-1): ERA Workplan. May 14.

Schafer (Schafer & Associates). 1999b. Chino Mines Administrative Order on Consent Site-wide Ecological Risk Assessment Technical Memorandum No. 2 (TM-2): Sampling Analysis and Data Needs. July 27.

United States Environmental Protection Agency (USEPA). 1992. EPA. Framework for Ecological Risk Assessment. EPA/630/R-92/001; February 1992.

United States Environmental Protection Agency (USEPA). 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. Interim Final. June.

United States Environmental Protection Agency (USEPA). 1998. Guidelines for Ecological Risk Assessment. EPA/630/R-95/002F. April.

United States Environmental Protection Agency (USEPA). 2007. ProUCL Statistical Software, v4.00.02.

WCC. 1997. Administrative Order on Consent, Phase I Ecological Remedial Investigation Proposal, Chino Mine Investigation Area. November.

TABLES

Table 1.1-1
Summary of Assessment Endpoints as Defined in the Sitewide Baseline Ecological Risk Assessment

Management Goal:

Prevent or remediate adverse direct or indirect effects on ecological communities or populations of ecological receptors from toxic exposure to chemicals in mine waste

Assessment Endpoint	Risk Hypotheses or Question	Measures
	Exposure Assessment	
1. **Vegetation Community of Upland Sites**	1. COC concentrations in soils or vegetation do not exceed reference	Distribution of metals in soils and vegetation from site and reference areas
	2. COC concentrations in site soils do not exceed screening level TRVs	Metal concentrations in soils, TRVs for vegetation
	3. Nutrient levels are sufficient to support normal vegetation growth	K, P, NO_2+NO_3 TOC, pH in soils of site and background
	4. What proportion of landscape unit with [metals] in soils exceeding TRV or site-specific risk-based criterion	Distribution of elevated metal concentrations in soils or sediments
	Effects Assessment	
	5. Existing vegetation community at site is not degraded with respect to reference	Vegetation community structure in site and background areas; results of range quality assessment; sites located along gradient of conditions if possible
	6. Are COC concentrations or altered physical conditions in soils inhibiting recruitment?	Vegetation community and phytotoxicity test results for germination, root elongation, seedling growth from gradient of soil conditions
	7. Dose-response relationship exists between toxicity and soil contamination	" "
	8. What proportion of landscape unit(s) with adverse effects?	Spatial distribution of areas exhibiting adverse effects; elevated concentrations
	9. Are habitats in landscape unit fractionated by physical disturbance or chemical contamination?	Mapped distribution of vegetation types, wildlife species that may be restricted to habitat types against metal concentrations

Table 1.1-1
Summary of Assessment Endpoints as Defined in the Sitewide Baseline Ecological Risk Assessment

Management Goal:

Prevent or remediate adverse direct or indirect effects on ecological communities or populations of ecological receptors from toxic exposure to chemicals in mine waste

Assessment Endpoint	Risk Hypotheses or Question	Measures
		Exposure Assessment
2 **Vegetation Community of Ephemeral Drainages**	1. COC concentrations in soils/sediments or vegetation exceed reference	Distribution of metals in soils and vegetation from site and reference areas
	2. COC concentrations in site soils exceed screening level TRVs	Metal concentrations in soils, TRVs for vegetation
	3. Dose-response relationship exists between residues and soil contamination	Metal concentrations in soils and plant tissues from co-located sites along gradient of conditions
	4. Nutrient levels are sufficient to support normal vegetation growth	K, P, NO_2+NO_3 TOC, pH in soils of site and background
	5. What proportion of landscape unit has [metals] in soils exceeding TRV or site-specific risk-based criterion?	Distribution of elevated metal concentrations in soils or sediments
		Effects Assessment
	6. Existing vegetation community at site is not degraded with respect to reference area	Qualitative comparison of species present to unaffected or less affected sites (reference condition may not be available)
	7. COC concentrations are not accumulating in plant tissues	Metal concentrations in soils and plant tissues from gradient of conditions
	8. Are COC concentrations or altered physical conditions in soils inhibiting recruitment?	Phytotoxicity test results for germination, root elongation, seedling growth from gradient of soil conditions
	9. Dose-response relationship exists between toxicity and soil contamination	" "
	10. What proportion of landscape unit(s) with adverse effects?	Distribution of areas exhibiting adverse effects; elevated concentrations
	11. Habitats in landscape unit fractionated by physical disturbance or chemical contamination?	Mapped distribution of vegetation types, wildlife species that may be restricted to habitat types against metal concentrations

Table 1.1-1
Summary of Assessment Endpoints as Defined in the Sitewide Baseline Ecological Risk Assessment

Management Goal:

Prevent or remediate adverse direct or indirect effects on ecological communities or populations of ecological receptors from toxic exposure to chemicals in mine waste

Assessment Endpoint	Risk Hypotheses or Question	Measures
	<u>Exposure Assessment</u>	
3 **Herbivorous, Insectivorous, and Omnivorous Birds**	1. COC exposure do not exceed TRVs (estimate by habitat type [i.e., upland, ephemeral drainage] and location on site)	COC concentrations in soils, seeds, foliage, invertebrates; TRVs for small and large granivorous, omnivorous, and insectivorous birds; Intake calculations
	2. COC in exposure media do not exceed reference levels	COC concentrations in soils, seeds, foliage from site units and reference area
	3. What soil concentrations are associated with exposures that exceed TRVs?	Correlation between COC concentrations in soils and either (a) concentrations in forage or prey or (b) bioaccumulation factors
	<u>Effects Assessment</u>	
	4. Habitat quality is not degraded in potentially affected areas	Habitat quality (vegetation community structure) in site vs. reference
	5. What portion of landscape unit with [metals] in soils and vegetation exceed risk-based criterion?	Spatial distribution of elevated metal concentrations in sediments, soils, and vegetation in landscape unit(s)
	<u>Exposure Assessment</u>	
4 **Raptors**	1. COC exposure do not exceed TRVs (estimate by habitat type [i.e., upland, ephemeral drainage] and location on site)	COC concentrations in soils, invertebrates, small mammals TRVs for raptors; Intake calculations
	2. COC in exposure media do not exceed reference levels	COC concentrations in soils, prey
	3. What soil concentrations are associated with exposures that exceed TRVs?	Correlation between COC concentrations in soils and either (a) concentrations in forage or prey or (b) bioaccumulation factors
	<u>Effects Assessment</u>	
	4. Habitat quality is not degraded in potentially affected areas	Habitat quality (vegetation community structure) in site vs. reference
	5. What portion of landscape unit with [metals] in soils and vegetation exceed risk-based criterion?	Spatial distribution of elevated metal concentrations in sediments, soils, and vegetation in landscape unit(s)

Table 1.1-1
Summary of Assessment Endpoints as Defined in the Sitewide Baseline Ecological Risk Assessment

Management Goal:

Prevent or remediate adverse direct or indirect effects on ecological communities or populations of ecological receptors from toxic exposure to chemicals in mine waste

Assessment Endpoint	Risk Hypotheses or Question	Measures
	<u>Exposure Assessment</u>	
5 **Herbivorous, Granivorous, and Omnivorous Small Mammals**	1. COC exposure do not exceed TRVs (estimate by habitat type [i.e., upland, ephemeral drainage] and location on site)	COC concentrations in soils, seeds, foliage, invertebrates; TRVs for small and large granivorous, omnivorous, and insectivorous birds; Intake calculations
	2. COC in exposure media do not exceed reference levels	COC concentrations in soils, seeds, foliage from site units and reference area
	3. What soil concentrations are associated with exposures that exceed TRVs?	Correlation between COC concentrations in soils and either (a) concentrations in forage or prey or (b) bioaccumulation factors
	<u>Effects Assessment</u>	
	4 Histopathology is associated with elevated concentrations in tissues	COC concentrations in liver, kidney; Histopathological assessment of tissues
	5 Habitat quality is not degraded on site	Habitat quality (vegetation community structure) in site vs. reference
	6 What portion of landscape unit with [metals] in soils and vegetation exceed risk-based criterion?	Spatial distribution of elevated metal concentrations in sediments, soils, and vegetation in landscape unit(s)
	<u>Exposure Assessment</u>	
6 **Ruminant Wildlife**	1. COC exposure do not exceed TRVs (estimate by habitat type [i.e., upland, ephemeral drainage] and location on site)	COC concentrations in soils, foliage of palatable species; TRVs for ruminants; Intake calculations
	2. COC in exposure media do not exceed reference levels	COC concentrations in soils, seeds, foliage from site units and reference area
	3. What soil concentrations are associated with exposures that exceed TRVs?	Correlation between COC concentrations in soils and either (a) concentrations in forage (b) bioaccumulation factors for uptake soil-forage
	<u>Effects Assessment</u>	
	4. Habitat quality is not degraded on site	Habitat quality (vegetation community structure) in site vs. reference
	5. What portion of landscape unit with [metals] in soils and vegetation exceed risk-based criterion?	Spatial distribution of elevated metal concentrations in sediments, soils, and vegetation in landscape unit(s)

Table 1.1-1
Summary of Assessment Endpoints as Defined in the Sitewide Baseline Ecological Risk Assessment

Management Goal:

Prevent or remediate adverse direct or indirect effects on ecological communities or populations of ecological receptors from toxic exposure to chemicals in mine waste

Assessment Endpoint	Risk Hypotheses or Question	Measures
	<u>Exposure Assessment</u>	
7 **Mammalian Predators**	1. COC exposure do not exceed TRVs (estimate by habitat type [i.e., upland, ephemeral drainage] and location on site)	COC concentrations in soils, small mammals; TRVs for mammals; Intake calculations
	2. COC in exposure media do not exceed reference levels	COC concentrations in soils, seeds, foliage from site units and reference area
	3. What soil concentrations are associated with exposures that exceed TRVs?	Correlation between COC concentrations in soils and either (a) concentrations in forage (b) bioaccumulation factors for uptake soil-forage
	<u>Effects Assessment</u>	
	4. Habitat quality is not degraded on site	Habitat quality (vegetation community structure) in site vs. reference
	5. What portion of landscape unit with [metals] in soils and vegetation exceed risk-based criterion?	Spatial distribution of elevated metal concentrations in sediments, soils, and vegetation in landscape unit(s)
	<u>Exposure Assessment</u>	
8 **Amphibians**	1. Metal concentrations in water of breeding areas do not exceed toxicity thresholds for amphibians or aquatic life	<u>Exposure Assessment</u> Data on water quality from temporary and permanent aquatic habitat
	2. COC in exposure media do not exceed reference levels	Data on water quality from temporary and permanent aquatic habitat in reference area
	<u>Effects Assessment</u>	
	3. Determine whether amphibians occur in aquatic habitats to the extent expected	Presence/absence of breeding amphibians in aquatic habitats; site and reference (if available)
	4. Sediment are not toxic to aquatic stages of amphibians	Data on metal content of sediment in temporary and aquatic habitats; sediment toxicity testing if necessary

Table 1.1-2

R-Squared Values from Linear Regression Analyses for Laboratory Phytotoxicity and Community Endpoints (All Sites) Originally Presented in the Sitewide BERA (NewFields, 2006)

	Community and Phytotoxicity Endpoints								
	Community		Dry Weight		Length		Other Measures		
	Richness	Canopy Cover	Stem	Root	Stem	Root	Nodules	Emergence	Survival
Chemical Variables									
pCu^{2+}	0.614	0.462	0.733	0.694	0.665	0.486	0.432	0.231	0.267
Soluble Cu (SPLP)	0.455	0.242	0.338	0.546	0.298	0.548	0.194	0.399	0.408
CaCl2 Sol Cu	0.507	0.067	0.337	0.373	0.178	0.313	0.480	0.084	0.118
Total Cu (ln trans)	0.472	0.240	0.305	0.411	0.176	0.369	0.407	0.106	0.104
pH, paste	0.461	0.100	0.215	0.202	0.339	0.151	0.364	0.053	0.090
Soluble Zn (SPLP)	0.231	0.058	0.095	0.150	0.064	0.179	0.118	0.221	0.209
Total Zn	0.000	0.032	0.036	0.036	0.117	0.042	0.104	0.054	0.075
Soluble Cd (SPLP)	0.002	0.077	0.021	0.024	0.007	0.002	0.032	0.003	0.001
Total Cd	0.037	0.002	0.002	0.001	0.011	0.001	0.152	0.001	0.000
Soluble Al (SPLP)	0.170	0.107	0.198	0.159	0.246	0.218	0.023	0.296	0.267
Total Al	0.116	0.033	0.195	0.112	0.221	0.089	0.010	0.031	0.034
Total Se	0.267	0.118	0.086	0.138	0.033	0.132	0.248	0.046	0.041
Physical Variables									
Soil DOC	0.071	0.367	0.307	0.108	0.257	0.021	0.056	0.033	0.038
Soil Organic Matter	0.029	0.005	0.006	0.003	0.003	0.027	0.141	0.086	0.072
% Silt	0.019	0.024	0.003	0.039	0.009	0.100	0.007	0.187	0.166
% Clay	0.117	0.049	0.078	0.105	0.080	0.035	0.033	0.006	0.003
% Sand	0.080	0.060	0.030	0.111	0.047	0.146	0.000	0.196	0.167

Shaded cells indicate highest R squared

Soluble copper data from Site 26 were eliminated for all endpoints

Table 1.1-3

Predictablity of pCu^{2+} in Chino ERA Soil Samples
Originally Presented in the Sitewide BERA (NewFields 2005)

Stepwise multiple regression was used to identify variables that were most important in predicting pCu2+. Soil pH and total copper concentration (ln-transformed) typically accounted for more than 90 percent of the varibility. Dissolved organic carbon was typically the third most important but contributed relatively little to predictive power.

Combination of Locations		Equation	R-squared
All Locations	2-var.	$3.28+(1.12*pH)-(0.64*\ln[Cu_{tot}])$	0.90
	3-var.	$2.77+(1.12*pH)-(0.62*\ln[Cu_{tot}])+(0.17*[DOC])$	0.92
Upland Study Only	2-var.	$6.16+(1*pH)-(1.02*\ln[Cu_{tot}])$	0.96
	3-var.	$4.63+(1*pH)-(0.84*\ln[Cu_{tot}])+(0.19*[DOC])$	0.96
Upland Study & Reference	2-var.	$7.34+(0.93*pH)-(1.15*\ln[Cu_{tot}])$	0.97
	3-var.	$6.47+(0.92*pH)-(1.04*\ln[Cu_{tot}])+(0.13*[DOC])$	0.97
Ephemeral Drainage	2-var.	$-0.56+(1.32*pH)-(0.18*\ln[Cu_{tot}])$	0.93
	3-var.	$1.15+(1.12*pH)-(0.18*\ln[Cu_{tot}])+(1.76*[DOC])$	0.96

Table 2.2-1
Predicted Cupric Ion Activity (pCu2+) in Ephemeral Drainage Sediment Samples
Hanover and Whitewater Creeks Investigation Unit ERA

Physical Reach	Sample Id	pH	Total Copper Concentration (mg/kg)	pCu2+	Toxic in Phytotoxicity Tests			
					Rye		Alfalfa	
					Emergence	Growth	Emergence	Growth
1	U02-3100	7.68	476.1	8.47				
	U02-3102	5.36	163	5.60				
	U02-ER001	6.4	549	6.75				
	U02-ER002	6.83	618	7.30				
	U02-ER003	6.6	449	7.05				
	U02-ER004	6.73	438	7.23				
	U02-2100	7.68	484.2	8.46				
	U02-2102	7.68	498.8	8.46				
	U02-ER005	7.65	544	8.40				
	U02-ER006	7.66	441	8.46				
	U02-ER007	7.66	463	8.45				
	U02-ER009	7.61	585	8.34				
	U02-ER010	6.4	423	6.80				
	ERA-29	7.42	459.7	7.67		x	x	x
2	U03-3200	5.38	983.8	5.30				
	ERA-32	7.59	419.5	7.92				
	U03-2200	5.66	611.4	5.76				
3	U03-3300	7	3250	7.22				
	U03-3302	6.43	1439	6.62				
	U03-3303	5.07	780.2	4.93				
	U03-3305	7.75	517.8	8.55				
	U03-3306	7.55	770.9	8.21				
	U03-3308	7.4	600.9	8.06				
	U03-3309	7.3	242.2	8.09				
	U03-3311	7.08	132.5	7.91				
	U03-3312	7.08	782.2	7.59				
	U03-3314	7.08	714.2	7.60				
	U03-3316	7.08	832.7	7.58				
	U03-3317	7.08	585.1	7.64				
	U03-3318	7.08	952.3	7.55				
	U03-3320	7.08	1454	7.47				
	U03-3321	7.08	956.6	7.55				
	U03-3322	7.08	1175	7.51				
	U03-2300	6.21	505.1	6.52				
	U03-2302	3.92	382.1	3.54				
	U03-2303	6.17	1307	6.29				
	U03-2305	4.45	680.7	4.14				
	U03-2306	6.3	485.2	6.64				
	U03-2307	4.73	531.9	4.55				
	U03-2309	6.02	1085	6.13				
	U03-2311	6	977.8	6.12				
	U03-2312	4.15	393.5	3.84				
	U03-2313	4.26	439.4	3.97				
	U03-2315	4.52	573.4	4.26				
3	U03-2316	3.73	1112	3.10				
	U03-2318	3.86	452.1	3.43				
	U03-2320	4.31	422.2	4.04				
	U03-2321	4.04	438.1	3.68				
	U03-2322	4.02	395.7	3.67				
	ERA-22	7.5	1120	7.19		x		x
	ERA-28	7.53	1060	7.26				
4	U03-3400	7.12	2384	7.44				
5	ERA 23	5.26	973	4.78				
	ERA 26	4.23	535	4	x	x	x	x
	U03-3500	4.35	979.8	3.94				
6	U03-3600	4.04	342.4	3.72				
	U03-3602	4.45	189.6	4.37				
	U03-3604	3.98	285.1	3.68				
	U03-2600 B	3.39	103.6	3.08				

Table 2.2-1
Predicted Cupric Ion Activity (pCu2+) in Ephemeral Drainage Sediment Samples
Hanover and Whitewater Creeks Investigation Unit ERA

Physical Reach	Sample Id	pH	Total Copper Concentration (mg/kg)	pCu2+	Toxic in Phytotoxicity Tests			
					Rye		Alfalfa	
					Emergence	Growth	Emergence	Growth
	U03-2602 B	6.18	324.8	6.56				
	U03-6600	3.71	369.6	3.27				
8	U03-3800	5.78	296.6	6.04				
	ERA-27	5.76	327.7	6.03				
	U03-2800	4.17	193	4.00				
9	U03-3900	7.53	345.6	8.33				
	U03-3901	7.4	540.9	8.08				
	U03-3902	5.36	981.4	5.28				
	U03-6900	7.34	98.1	8.30				
	U03-2900 B	7.94	139.4	9.03				
	U03-2901 B	7.18	179.1	7.98				
BC	ERA-33	6.59	176.2	7.36				
SC	ERA-31	7.73	77.8	9.14	x	x	x	x
	U03-51050	4.18	208	4.00				
	U03-51052	4.73	335	4.64				
	U03-51053	3.87	210	3.59				
	U03-51055	7.38	171	8.26				
	U03-51056	3.72	196	3.40				
	U03-51058	4.3	263	4.11				
	U03-51060	6.33	482	6.68				
	U03-51062	7.83	76	9.00				
	U03-51063	7.87	92	9.01				
LWW	U03-31152	6.48	314	6.96				
	U03-31259	6.83	261	7.45				
	U03-31264	7.49	343	8.28				
	U03-31368	7.86	266	8.81				
	U03-31578	6.84	371	7.40				
	U03-11150	4.62	183	4.60				
	U03-11254	4.09	233	3.86				
	U03-11255	4.42	281	4.26				
	U03-11256	4.37	118	4.35				
	U03-11260	6.57	2360	6.71				
	U03-11261	6.31	2000	6.40				
	U03-11262	4.65	465	4.47				
	U03-11288	6.49	784	6.81				
	U03-11366	7.85	159	8.89				
	U03-11471	7.34	388	8.06				
	U03-11576	6.41	157	6.99				
	U03-11579	7.01	463	7.59				
	U03-61153	6.83	761	7.26				
	U03-61258	6.2	236	6.64				
	U03-61265	7.7	128	8.73				
	U03-61369	7.39	101	8.36				
	U03-61474	7.83	43	9.10				
	U03-61575	7.84	94	8.97				
	U03-11284	6.31	429	6.68				
	U03-11586	5.72	941	5.76				
	U03-11682	8.08	41	9.44				
	U03-11680	7.55	43	8.73				

pCu2+ = $-0.56+(1.32*pH)-(0.18*\ln[Cu_{tot}])$
Note: Phytotoxicity tests performed as part of the Site-wide BERA (2005).

Table 3.1-1
Comparison of H/WCIU and Site-wide BERA
Upper-Bound Exposure Point Concentrations

COPC	95th Percentile	95th Percentile Upland Soils (NewFields 2005)	95 UCL	UCL Statistic
H/WCIU				
Cadmium	***5.82***	3.22	3.2	97.5 % Chebyshev (Mean, Sd) UCL
Chromium	***24.1***	16.8	14.55	95% Student's t UCL
Copper	1446	2310	631	95% Approximate Gamma UCL
Lead	***494***	40.9	314	97.5% Chebyshev (Mean, Sd) UCL
Molybdenum	20.9	43	10	95% Approximate Gamma UCL
Selenium	1.07	2	0.597	95% Chebyshev (Mean,SD) UCL
Zinc	***2357***	91.5	886	95% H-UCL
Physical Reach 1				
Cadmium	***11.5***	3.22	5.76	95% Approximate Gamma UCL
Chromium	16.2	16.8	14.7	95% Student's t UCL
Copper	618	2310	515	95% Student's t UCL
Lead	***1470***	40.9	504	95% Approximate Gamma UCL
Molybdenum	9.76	43	10.1	95% Chebyshev (Mean, Sd) UCL
Selenium	1.6	2	0.74	95% Approximate Gamma UCL
Zinc	***4637***	91.5	2338	95% Approximate Gamma UCL
Physical Reach 2				
Cadmium	***19.1***	3.22	19.1	---
Chromium	***21.3***	16.8	21.3	---
Copper	984	2310	984	---
Lead	***2128***	40.9	2128	---
Molybdenum	12.3	43	12.3	---
Selenium	0.51	2	0.51	---
Zinc	***8350***	91.5	8350	---
Physical Reach 3				
Cadmium	***5.26***	3.22	2.39	95% Approximate Gamma UCL
Chromium	***21.2***	16.8	18.1	95% Student's t UCL
Copper	1813	2310	956	95% Approximate Gamma UCL
Lead	***438***	40.9	242	95% Student's t UCL
Molybdenum	11.8	43	8.43	95% Student's t UCL
Selenium	0.95	2	0.68	95% Chebyshev (Mean, Sd) UCL
Zinc	***1722***	91.5	873	95% Approximate Gamma UCL
Physical Reach 4 and 5				
Cadmium	2.42	3.22	2.42	---
Chromium	11.25	16.8	11.25	---
Copper	***2384***	2310	***2384***	---
Lead	***53.2***	40.9	***53.2***	---
Molybdenum	37	43	37	---
Selenium	1.96	2	1.96	---
Zinc	***175***	91.5	***175***	---
Physical Reach 6 and 7				
Cadmium	2.47	3.22	2.25	95% Chebyshev (Mean, Sd) UCL
Chromium	12.9	16.8	11.2	95% Student's t UCL
Copper	360	2310	350	95% Student's t UCL
Lead	***48.3***	40.9	44.8	95% Student's t UCL
Molybdenum	14.6	43	13.4	95% Student's t UCL
Selenium	1.08	2	0.93	95% Student's t UCL
Zinc	***141***	91.5	111	95% Approximate Gamma UCL
Physical Reach 8 and 9				
Cadmium	0.7	3.22	0.53	95% Student's t UCL
Chromium	***20***	16.8	13.0	95% Student's t UCL
Copper	981	2310	565	95% Approximate Gamma UCL
Lead	39.4	40.9	32.0	95% Student's t UCL
Molybdenum	21.2	43	14.1	95% Student's t UCL
Selenium	0.8	2	0.58	95% Approximate Gamma UCL
Zinc	***174***	91.5	115	95% Student's t UCL
Bayard Canyon				
Cadmium	1.3	3.22	1.3	---
Chromium	3.8	16.8	3.8	---
Copper	176	2310	176	---
Lead	***551***	40.9	***551***	---
Molybdenum	3.5	43	3.5	---
Selenium	0.11	2	0.11	---
Zinc	***243***	91.5	***243***	---
Side Channel				
Cadmium	0.98	3.22	0.64	95% Student's t UCL
Chromium	***20.5***	16.8	17.2	95% Student's t UCL
Copper	482	2310	284	95% Student's t UCL
Lead	***47.4***	40.9	30.2	95% Student's t UCL
Molybdenum	21.1	43	11.6	95% Approximate Gamma UCL
Selenium	0.38	2	0.18	95% Student's t UCL
Zinc	***225***	91.5	135	95% Student's t UCL
Lower Whitewater Creek				
Cadmium	1.15	3.22	0.53	95% Approximate Gamma UCL
Chromium	***23.4***	16.8	14.8	95% Student's t UCL
Copper	2216	2310	629	95% Approximate Gamma UCL
Lead	***83.6***	40.9	39.1	95% Approximate Gamma UCL
Molybdenum	29	43	14.1	95% Approximate Gamma UCL
Selenium	0.79	2	0.44	95% Chebyshev (Mean, Sd) UCL
Zinc	***318***	91.5	153	95% Approximate Gamma UCL

All units presented as mg/kg dry weight
COPC has a higher 95th Percentile in H/WCIU data than observed in ERI Data
Max detect used. Insufficient sample numbers available to calculate a UCL or max detect equivalent to 95th percentile.

Table 3.2-1
Calculated Soil Screening Levels For Copper
Originally Presented in the Site-wide BERA (NewFields 2005)

				SSLs (mg/kg) Based on Target Hazard Quotient						
Receptor	**Analyte**	**Toxicity Reference Value (mg/kg body weight/day)**	**Absorbtion Factor (Af_s)**	**1**	**2**	**5**	**10**	**25**	**50**	**100**
Dark-Eyed Junco	Copper, total	28 (NOAEL)	0.1	390	781	1,952	3,904	9,761	19,522	39,044
			0.25	333	667	1,666	3,333	8,331	16,663	33,325
			0.5	268	536	1,339	2,679	6,697	13,393	26,786
			1	192	385	962	1,924	4,809	9,619	19,237
		42 (LOAEL)	0.1	586	1,171	2,928	5,857	14,641	29,283	58,566
			0.25	500	1000	2,499	4,999	12,497	24,994	49,988
			0.5	402	804	2,009	4,018	10,045	20,090	40,180
			1	289	577	1,443	2,886	7,214	14,428	28,856

Note: The small ground-feeding bird (Dark-Eyed Junco) was shown to be the most sensitive receptor to copper; therefore, SSLs derived for this receptor would also be protective of all other receptors evaluated in the Wildlife Risk Analysis.

Af_s = Bioavailability factor for soil ingestion.

Table 3.2-2
Hazard Quotients for Copper; Small Ground-Feeding Bird Receptor
Hanover and Whitewater Creeks IU Ecological Risk Assessment

Toxicity Reference Value (mg/kg body weight/day)	Absorbtion Factor (AF_s)	SSL (mg/kg)	Exposure Point Concentrations (mg/kg)			
			95th Percentile	*75th Percentile*	*Median*	*95th UCL*
			1,446	689	439	631
			Hazard Quotients			
28 (NOAEL)	0.1	390	3.7	1.8	1.1	1.6
	0.25	333	4.3	2.1	1.3	1.9
	0.5	268	5.4	2.6	1.6	2.4
	1	192	7.5	3.6	2.3	3.3
42 (LOAEL)	0.1	586	2.5	1.2	0.7	1.1
	0.25	500	2.9	1.4	0.9	1.3
	0.5	402	3.6	1.7	1.1	1.6
	1	289	5.0	2.4	1.5	2.2

Note: The small ground-feeding bird (Dark-Eyed Junco) was shown to be the most sensitive receptor to copper; therefore, SSLs derived for this receptor would also be protective of all other receptors evaluated in the Wildlife Risk Analysis.

Table 3.2-3
Hazard Quotients For Copper; Small Ground-Feeding Bird Receptor
Hanover and Whitewater Creeks IU Ecological Risk Assessment
Physical Reach 1

Toxicity Reference Value (mg/kg body weight/day)	Absorbtion Factor (AF_s)	SSL (mg/kg)	Exposure Point Concentrations (mg/kg)			
			95th Percentile	*75th Percentile*	*Median*	*95th UCL*
			618	**544**	**463**	**515**
			Hazard Quotients			
28 (NOAEL)	0.1	390	1.6	1.4	1.2	1.3
	0.25	333	1.9	1.6	1.4	1.5
	0.5	268	2.3	2.0	1.7	1.9
	1	192	3.2	2.8	2.4	2.7
42 (LOAEL)	0.1	586	1.1	0.9	0.8	0.9
	0.25	500	1.2	1.1	0.9	1.0
	0.5	402	1.5	1.4	1.2	1.3
	1	289	2.1	1.9	1.6	1.8

Note: The small ground-feeding bird (Dark-Eyed Junco) was shown to be the most sensitive receptor to copper; therefore, SSLs derived for this receptor would also be protective of all other receptors evaluated in the Wildlife Risk Analysis.

Table 3.2-4
Hazard Quotients For Copper; Small Ground-Feeding Bird Receptor
Hanover and Whitewater Creeks IU Ecological Risk Assessment
Physical Reach 3

Toxicity Reference Value (mg/kg body weight/day)	Absorbtion Factor (AF_s)	SSL (mg/kg)	Exposure Point Concentrations (mg/kg)			
			95th Percentile	*75th Percentile*	*Median*	*95th UCL*
			1,813	**1060**	**681**	**956**
			Hazard Quotients			
28 (NOAEL)	0.1	390	4.6	2.7	1.7	2.4
	0.25	333	5.4	3.2	2.0	2.9
	0.5	268	6.8	4.0	2.5	3.6
	1	192	9.4	5.5	3.5	5.0
42 (LOAEL)	0.1	586	3.1	1.8	1.2	1.6
	0.25	500	3.6	2.1	1.4	1.9
	0.5	402	4.5	2.6	1.7	2.4
	1	289	6.3	3.7	2.4	3.3

Note: The small ground-feeding bird (Dark-Eyed Junco) was shown to be the most sensitive receptor to copper; therefore, SSLs derived for this receptor would also be protective of all other receptors evaluated in the Wildlife Risk Analysis.

Table 3.2-5
Hazard Quotients For Copper; Small Ground-Feeding Bird Receptor
Hanover and Whitewater Creeks IU Ecological Risk Assessment
Physical Reach 4 and 5

Toxicity Reference Value (mg/kg body weight/day)	Absorbtion Factor (AF_s)	SSL (mg/kg)	Exposure Point Concentrations (mg/kg)			
			95th Percentile	*75th Percentile*	*Median*	*95th UCL*
			2,384	**2033**	**976**	**---**
			Hazard Quotients			
28 (NOAEL)	0.1	390	6.1	5.2	2.5	---
	0.25	333	7.2	6.1	2.9	---
	0.5	268	8.9	7.6	3.6	---
	1	192	12.4	10.6	5.1	---
42 (LOAEL)	0.1	586	4.1	3.5	1.7	---
	0.25	500	4.8	4.1	2.0	---
	0.5	402	5.9	5.1	2.4	---
	1	289	8.3	7.0	3.4	---

Note: The small ground-feeding bird (Dark-Eyed Junco) was shown to be the most sensitive receptor to copper; therefore, SSLs derived for this receptor would also be protective of all other receptors evaluated in the Wildlife Risk Analysis.

Table 3.2-6
Hazard Quotients For Copper; Small Ground-Feeding Bird Receptor
Hanover and Whitewater Creeks IU Ecological Risk Assessment
Physical Reach 6 and 7

Toxicity Reference Value (mg/kg body weight/day)	Absorbtion Factor (AF_s)	SSL (mg/kg)	Exposure Point Concentrations (mg/kg)			
			95th Percentile	*75th Percentile*	*Median*	*95th UCL*
			360	**347**	**305**	**350**
			Hazard Quotients			
28 (NOAEL)	0.1	390	0.9	0.9	0.8	0.9
	0.25	333	1.1	1.0	0.9	1.1
	0.5	268	1.3	1.3	1.1	1.3
	1	192	1.9	1.8	1.6	1.8
42 (LOAEL)	0.1	586	0.6	0.6	0.5	0.6
	0.25	500	0.7	0.7	0.6	0.7
	0.5	402	0.9	0.9	0.8	0.9
	1	289	1.2	1.2	1.1	1.2

Note: The small ground-feeding bird (Dark-Eyed Junco) was shown to be the most sensitive receptor to copper; therefore, SSLs derived for this receptor would also be protective of all other receptors evaluated in the Wildlife Risk Analysis.

Table 3.2-7
Hazard Quotients For Copper; Small Ground-Feeding Bird Receptor
Hanover and Whitewater Creeks IU Ecological Risk Assessment
Physical Reach 8 and 9

Toxicity Reference Value (mg/kg body weight/day)	Absorbtion Factor (AF_s)	SSL (mg/kg)	Exposure Point Concentrations (mg/kg)			
			95th Percentile	*75th Percentile*	*Median*	*95th UCL*
			981	**443**	**297**	**565**
			Hazard Quotients			
28 (NOAEL)	0.1	390	2.5	1.1	0.8	1.4
	0.25	333	2.9	1.3	0.9	1.7
	0.5	268	3.7	1.7	1.1	2.1
	1	192	5.1	2.3	1.5	2.9
42 (LOAEL)	0.1	586	1.7	0.8	0.5	1.0
	0.25	500	2.0	0.9	0.6	1.1
	0.5	402	2.4	1.1	0.7	1.4
	1	289	3.4	1.5	1.0	2.0

Note: The small ground-feeding bird (Dark-Eyed Junco) was shown to be the most sensitive receptor to copper; therefore, SSLs derived for this receptor would also be protective of all other receptors evaluated in the Wildlife Risk Analysis.

Table 3.2-8
Hazard Quotients For Copper; Small Ground-Feeding Bird Receptor
Hanover and Whitewater Creeks IU Ecological Risk Assessment
Side Channel

Toxicity Reference Value (mg/kg body weight/day)	Absorbtion Factor (AF_s)	SSL (mg/kg)	Exposure Point Concentrations (mg/kg)			
			95th Percentile	*75th Percentile*	*Median*	*95th UCL*
			482	**281**	**202**	**284**
			Hazard Quotients			
28 (NOAEL)	0.1	390	1.2	0.7	0.5	0.7
	0.25	333	1.4	0.8	0.6	0.9
	0.5	268	1.8	1.0	0.8	1.1
	1	192	2.5	1.5	1.1	1.5
42 (LOAEL)	0.1	586	0.8	0.5	0.3	0.5
	0.25	500	1.0	0.6	0.4	0.6
	0.5	402	1.2	0.7	0.5	0.7
	1	289	1.7	1.0	0.7	1.0

Note: The small ground-feeding bird (Dark-Eyed Junco) was shown to be the most sensitive receptor to copper; therefore, SSLs derived for this receptor would also be protective of all other receptors evaluated in the Wildlife Risk Analysis.

Table 3.2-9
Hazard Quotients For Copper; Small Ground-Feeding Bird Receptor
Hanover and Whitewater Creeks IU Ecological Risk Assessment
Lower Whitewater Creek

Toxicity Reference Value (mg/kg body weight/day)	Absorbtion Factor (AF_s)	SSL (mg/kg)	Exposure Point Concentrations (mg/kg)			
			95th Percentile	*75th Percentile*	*Median*	*95th UCL*
			2,216	**463**	**266**	**629**
			Hazard Quotients			
28 (NOAEL)	0.1	390	5.7	1.2	0.7	1.6
	0.25	333	6.6	1.4	0.8	1.9
	0.5	268	8.3	1.7	1.0	2.3
	1	192	11.5	2.4	1.4	3.3
42 (LOAEL)	0.1	586	3.8	0.8	0.5	1.1
	0.25	500	4.4	0.9	0.5	1.3
	0.5	402	5.5	1.2	0.7	1.6
	1	289	7.7	1.6	0.9	2.2

Note: The small ground-feeding bird (Dark-Eyed Junco) was shown to be the most sensitive receptor to copper; therefore, SSLs derived for this receptor would also be protective of all other receptors evaluated in the Wildlife Risk Analysis.

Table 3.3-1
Soil Screening Levels For Cadmium. Chromium, Lead and Zinc
Hanover and Whitewater Creeks Investigation Unit

		Cadmium (100% BAF)	Chromium (100% BAF)	Lead (25% BAF)	Zinc (100% BAF)
Small Ground-Feeding Bird	NOAEL	10.6	6.6	34.9	13.5
	LOAEL	150	66	78.6	282
Small Mammal	NOAEL	63.3	81.4	5930	577
	LOAEL	127	814	59300	1154

Note: All units are presented in mg/kg.

Table 3.4-1
Medican Bioconcentration Factors
Originally Presented in the Site-wide BERA (NewFields 2005)

	Median Bioconcentration Factor		
Soil to -	**Seed**	**Foliage**	**Invertebrate**
Cadmium	0.09	0.132	0.25
Copper	0.073	0.121	0.169
Lead	0.108	0.0659	0.012
Zinc	0.759	0.72	1.23

Table 3.4-2
Hazard Quotient Calculations
Granivorous Small Ground Feeding Bird
Hanover and Whitewater Creeks IU

Analyte	Location	Ignestion Rate Food (WW kg/kg BW/day)	Diet Composition			Tissue Concentration (mg/kg)			Food Exposure (mg/kg/day)				Percent of Diet as Soil	Ingestion Rate Soil (DW kg/kg BW/day)	Soil Concentration (mg/kg)	Availability Factor	Soil Exposure	Total Dose	Toxicity Reference Value		Hazard Quotient	
			Foliage (0%)	Seed (100%)	Invertebrate (0%)	Foliage	Seed	Invertebrate	Foliage	Seed	Invertebrate	Total							NOAEL	LOAEL	NOAEL	LOAEL
Physical Reach 1																						
Cd	B45.8W	0.82	0	1	0	0.7	0.2	0.9	0	0.2	0	0.2	10	0.082	2.9	1.0	0.2	0.4	1.7	24	0.3	0.02
Cd	B47.2E	0.82	0	1	0	0.5	0.2	0.2	0	0.1	0	0.1	10	0.082	4.0	1.0	0.3	0.5	1.7	24	0.3	0.02
Cd	O43.5W	0.82	0	1	0	2.5	0.1	0.6	0	0.1	0	0.1	10	0.082	4.7	1.0	0.4	0.5	1.7	24	0.3	0.02
Cd	O44.2E	0.82	0	1	0	0.7	0.1	0.8	0	0.1	0	0.1	10	0.082	6.0	1.0	0.5	0.6	1.7	24	0.3	0.02
Cd	O48.8E	0.82	0	1	0	0.9	0.1	0.3	0	0.1	0	0.1	10	0.082	4.6	1.0	0.4	0.5	1.7	24	0.3	0.02
Cd	ERA-29	0.82	0	1	0	0.7	1.2	1.9	0	1	0	1	10	0.082	6.0	1	0.5	1.4	1.7	24	0.9	0.1
Cu	B45.8W	0.82	0	1	0	10.5	16.9	79.7	0	13.9	0	13.9	10	0.082	463	0.5	19	32.8	28	42	1.2	0.8
Cu	B47.2E	0.82	0	1	0	11.1	5.2	11.5	0	4.3	0	4.3	10	0.082	544	0.5	22.3	26.6	28	42	0.9	0.6
Cu	O43.5W	0.82	0	1	0	10.2	11.9	54.9	0	9.8	0	9.8	10	0.082	438	0.5	18	27.7	28	42	1.0	0.7
Cu	O44.2E	0.82	0	1	0	11.6	3.5	28.1	0	2.9	0	2.9	10	0.082	449	0.5	18.4	21.3	28	42	0.8	0.5
Cu	O48.8E	0.82	0	1	0	12.9	4.4	29.2	0	3.6	0	3.6	10	0.082	549	0.5	22.5	26.1	28	42	0.9	0.6
Cu	ERA-29	0.82	0	1	0	16.3	38.7	34.3	0	31.7	0	31.7	10	0.082	459.7	0.5	18.8	50.6	28	42	1.8	1.2
Pb	B45.8W	0.82	0	1	0	0.7	11.1	2.2	0	9.1	0	9.1	10	0.082	126	0.25	2.6	11.7	4	9	2.9	1.3
Pb	B47.2E	0.82	0	1	0	1.4	3.0	1.9	0	2.5	0	2.5	10	0.082	169	0.25	3.5	5.9	4	9	1.5	0.7
Pb	O43.5W	0.82	0	1	0	1.2	2.9	5.8	0	2.4	0	2.4	10	0.082	571	0.25	11.7	14.1	4	9	3.5	1.6
Pb	O44.2E	0.82	0	1	0	3.4	5.9	2.6	0	4.8	0	4.8	10	0.082	458	0.25	9.4	14.2	4	9	3.6	1.6
Pb	O48.8E	0.82	0	1	0	1.6	4.0	1.5	0	3.2	0	3.2	10	0.082	312	0.25	6.4	9.6	4	9	2.4	1.1
Pb	ERA-29	0.82	0	1	0	1.6	7.1	0.8	0	5.8	0	5.8	10	0.082	365.7	0.25	7.5	13.3	4	9	3.3	1.5
Zn	B45.8W	0.82	0	1	0	101	77	94.3	0	63.1	0	63.1	10	0.082	1220	1.0	100	163.2	10	210	16.3	0.8
Zn	B47.2E	0.82	0	1	0	112	23.6	42.9	0	19.4	0	19.4	10	0.082	1680	1.0	137.8	157.1	10	210	15.7	0.7
Zn	O43.5W	0.82	0	1	0	98	68	102	0	55.8	0	55.8	10	0.082	2040	1.0	167.3	223	10	210	22.3	1.1
Zn	O44.2E	0.82	0	1	0	152	28.7	90.4	0	23.5	0	23.5	10	0.082	2500	1.0	205	228.5	10	210	22.9	1.1
Zn	O48.8E	0.82	0	1	0	123	24.2	85.0	0	19.8	0	19.8	10	0.082	1930	1.0	158.3	178.1	10	210	17.8	0.8
Zn	ERA-29	0.82	0	1	0	250.8	216.2	83.8	0	177.3	0	177.3	10	0.082	2240	1	183.7	361	10	210	36.1	1.7
Physical Reach 2																						
Cd	ERA-32	0.82	0	1	0	1.7	1.47	0.49	0	1.20	0	1.20	10	0.082	19.1	1	1.6	2.8	1.7	24	1.6	0.1
Cu	ERA-32	0.82	0	1	0	42.3	34.7	33.9	0	28.5	0	28.5	10	0.082	419.5	0.5	17.2	45.7	28	42	1.6	1.1
Pb	ERA-32	0.82	0	1	0	40.6	17.2	4.6	0	14.1	0	14.1	10	0.082	2128	0.25	43.6	57.7	4	9	14.4	6.4
Zn	ERA-32	0.82	0	1	0	446	250.7	89.6	0	205.5	0	205.5	10	0.082	8350	1	684.7	890.2	10	210	89	4.2
Physical Reach 3																						
Cd	ERA-22	0.82	0	1	0	0.9	1.05	0.3	0	0.9	0	0.86	10	0.082	4.9	1	0.4	1.3	1.7	24	0.7	0.1
Cd	ERA-28	0.82	0	1	0	0.9	0.2	0.2	0	0.2	0	0.15	10	0.082	3.5	1	0.3	0.4	1.7	24	0.3	0.02
Cu	ERA-22	0.82	0	1	0	144	36.6	45.5	0	30.0	0	30	10	0.082	1120	0.5	45.9	75.9	28	42	2.7	1.8
Cu	ERA-28	0.82	0	1	0	42.6	30.8	56.4	0	25.3	0	25.3	10	0.082	1060	0.5	43.5	68.7	28	42	2.5	1.6
Pb	ERA-22	0.82	0	1	0	3.4	1.1	0.8	0	0.9	0	0.94	10	0.082	161.3	0.25	3.3	4.2	4	9	1.1	0.5
Pb	ERA-28	0.82	0	1	0	9.5	4.2	0.3	0	3.4	0	3.42	10	0.082	223	0.25	4.6	8	4	9	2.0	0.9
Zn	ERA-22	0.82	0	1	0	258	77.9	74.5	0	63.9	0	63.9	10	0.082	1520	1	124.6	188.5	10	210	18.9	0.9
Zn	ERA-28	0.82	0	1	0	254	85.4	98.7	0	70	0	70.0	10	0.082	1182	1	96.9	166.9	10	210	16.7	0.8
Physical Reach 5																						
Cd	ERA-23	0.82	0	1	0	0.2	0.5	0.5	0	0.4	0	0.40	10	0.082	1.60	1	0.1	0.5	1.7	24	0.3	0.02
Cd	ERA-26	0.82	0	1	0	0.1	0.1	0.1	0	0.05	0	0.05	10	0.082	0.6	1	0.0	0.1	1.7	24	0.1	0.004
Cu	ERA-23	0.82	0	1	0	70	23.9	51.3	0	19.6	0	19.6	10	0.082	973	0.5	39.9	59.5	28	42	2.1	1.4
Cu	ERA-26	0.82	0	1	0	72.8	46.2	90.4	0	37.9	0	37.9	10	0.082	535	0.5	21.9	59.8	28	42	2.1	1.4
Pb	ERA-23	0.82	0	1	0	2.1	7.2	0.2	0	5.9	0	5.9	10	0.082	21.4	0.25	0.4	6.4	4	9	1.6	0.7
Pb	ERA-26	0.82	0	1	0	0.9	1.3	0.2	0	1.04	0	1.04	10	0.082	13.7	0.25	0.3	1.3	4	9	0.3	0.1
Zn	ERA-23	0.82	0	1	0	25.3	40.7	43.3	0	33.4	0	33.4	10	0.082	35.6	1	2.9	36.3	10	210	3.6	0.2
Zn	ERA-26	0.82	0	1	0	32.3	39	22.3	0	32	0	32.0	10	0.082	18.1	1	1.5	33.5	10	210	3.3	0.2
Physical Reach 8																						
Cd	ERA-27	0.82	0	1	0	0.2	0.2	0.08	0	0.1	0	0.13	10	0.082	0.70	1	0.1	0.2	1.7	24	0.1	0.01
Cu	ERA-27	0.82	0	1	0	43.9	27.8	44.7	0	22.8	0	22.8	10	0.082	327.7	0.5	13.4	36.3	28	42	1.3	0.9
Pb	ERA-27	0.82	0	1	0	2.0	1.7	0.1	0	1.4	0	1.4	10	0.082	34.6	0.25	0.7	2.1	4	9	0.5	0.2
Zn	ERA-27	0.82	0	1	0	59.7	61.0	41	0	50.05	0	50	10	0.082	107.9	1	8.8	58.9	10	210	5.9	0.3
Side Channel Area																						
Cd	SC-1	0.82	0	1	0	1.0	*1.0*	0.1	0	0.8	0	0.8	10	0.082	0.2	1.0	0.02	0.8	1.7	24	0.5	0.03
Cd	SC-2	0.82	0	1	0	2.0	*2.0*	0.2	0	1.6	0	1.6	10	0.082	0.2	1.0	0.02	1.6	1.7	24	1.0	0.1
Cd	SC-3	0.82	0	1	0	3.2	*3.2*	0.1	0	2.6	0	2.6	10	0.082	0.2	1.0	0.02	2.6	1.7	24	1.5	0.1
Cd	ERA-31	0.82	0	1	0	0.1	0.1	0.1	0	0.1	0	0.1	10	0.082	0.9	1	0.1	0.1	1.7	24	0.1	0.01
Cu	SC-1	0.82	0	1	0	25.1	*25.1*	49.3	0	20.6	0	20.6	10	0.082	192.3	0.5	7.9	28.5	28	42	1.0	0.7
Cu	SC-2	0.82	0	1	0	47.1	*47.1*	55.5	0	38.6	0	38.6	10	0.082	192.3	0.5	7.9	46.5	28	42	1.7	1.1
Cu	SC-3	0.82	0	1	0	47.4	*47.4*	32.8	0	38.9	0	38.9	10	0.082	192.3	0.5	7.9	46.8	28	42	1.7	1.1
Cu	ERA-31	0.82	0	1	0	9.3	12.3	19.1	0	10.1	0	10.1	10	0.082	77.8	0.5	3.2	13.3	28	42	0.5	0.3
Pb	SC-1	0.82	0	1	0	0.9	*0.9*	0.6	0	0.7	0	0.7	10	0.082	23.6	0.25	0.5	1.2	4	9	0.3	0.1
Pb	SC-2	0.82	0	1	0	1.6	*1.6*	0.1	0	1.3	0	1.3	10	0.082	23.6	0.25	0.5	1.8	4	9	0.4	0.2
Pb	SC-3	0.82	0	1	0	5.7	*5.7*	0.3	0	4.7	0	4.7	10	0.082	23.6	0.25	0.5	5.1	4	9	1.3	0.6
Pb	ERA-31	0.82	0	1	0	0.9	0.9	0.2	0	0.7	0	0.7	10	0.082	11.7	0.25	0.2	1	4	9	0.2	0.1

Table 3.4-2
Hazard Quotient Calculations
Granivorous Small Ground Feeding Bird
Hanover and Whitewater Creeks IU

		Ignestion Rate	Diet Composition			Tissue Concentration (mg/kg)			Food Exposure (mg/kg/day)				Percent of	Ingestion Rate	Soil				Toxicity Reference Value		Hazard Quotient	
Analyte	Location	Food (WW kg/kg BW/day)	Foliage (0%)	Seed (100%)	Invertebrate (0%)	Foliage	Seed	Invertebrate	Foliage	Seed	Invertebrate	Total	Diet as Soil	Soil (DW kg/kg BW/day)	Concentration (mg/kg)	Availability Factor	Soil Exposure	Total Dose	NOAEL	LOAEL	NOAEL	LOAEL
Zn	SC-1	0.82	0	1	0	65	*65*	42.4	0	53.3	0	53.3	10	0.082	94.2	1.0	7.7	61	10	210	6.1	0.3
Zn	SC-2	0.82	0	1	0	90	*90*	58.2	0	73.8	0	73.8	10	0.082	94.2	1.0	7.7	81.5	10	210	8.2	0.4
Zn	SC-3	0.82	0	1	0	123	*123*	40.7	0	100.9	0	100.9	10	0.082	94.2	1.0	7.7	108.6	10	210	10.9	0.5
Zn	ERA-31	0.82	0	1	0	21.2	39	42.4	0	32	0	32	10	0.082	37.9	1	3.1	35.1	10	210	3.5	0.2
Lower Whitewater Creek																						
Cd	LW-03-A	0.82	0	1	0	0.1	*0.1*	0.3	0	0.1	0	0.1	10	0.082	0.01	1	0.0008	0.1	1.7	24	0.1	0.004
Cd	LW-03E-A	0.82	0	1	0	0.6	*0.6*	0.2	0	0.5	0	0.5	10	0.082	0.01	1	0.0008	0.5	1.7	24	0.3	0.02
Cd	LW-04-A	0.82	0	1	0	0.3	*0.3*	0.1	0	0.3	0	0.3	10	0.082	0.5	1	0.04	0.3	1.7	24	0.2	0.01
Cd	LW-05-A	0.82	0	1	0	0.03	*0.03*	N/A	0	0.02	N/A	0.02	10	0.082	0.5	1	0.04	0.06	1.7	24	0.0	0.003
Cd	LW-06-A	0.82	0	1	0	0.1	*0.1*	0.2	0	0.1	0	0.08	10	0.082	0.48	1	0.04	0.1	1.7	24	0.1	0.01
Cu	LW-03-A	0.82	0	1	0	19.3	*19.3*	30.8	0	15.8	0	15.8	10	0.082	233	0.5	9.6	25.4	28	42	0.9	0.6
Cu	LW-03E-A	0.82	0	1	0	34.5	*34.5*	21.1	0	28.3	0	28.3	10	0.082	233	0.5	9.6	37.8	28	42	1.4	0.9
Cu	LW-04-A	0.82	0	1	0	32.7	*32.7*	78.0	0	26.8	0	26.8	10	0.082	954.2	0.5	39.1	65.9	28	42	2.4	1.6
Cu	LW-05-A	0.82	0	1	0	14	*14*	N/A	0	11.5	N/A	11.5	10	0.082	954.2	0.5	39.1	50.6	28	42	1.8	1.2
Cu	LW-06-A	0.82	0	1	0	17.6	*17.6*	41.4	0	14.4	0	14.4	10	0.082	271.2	0.5	11.1	25.6	28	42	0.9	0.6
Pb	LW-03-A	0.82	0	1	0	0.2	*0.2*	2.2	0	0.2	0	0.20	10	0.082	21.2	0.25	0.4	0.6	4	9	0.2	0.1
Pb	LW-03E-A	0.82	0	1	0	0.7	*0.7*	0.4	0	0.5	0	0.5	10	0.082	21.2	0.25	0.4	1	4	9	0.2	0.1
Pb	LW-04-A	0.82	0	1	0	0.1	*0.1*	0.5	0	0.05	0	0.05	10	0.082	37.5	0.25	0.8	0.8	4	9	0.2	0.1
Pb	LW-05-A	0.82	0	1	0	0.1	*0.1*	N/A	0	0.05	N/A	0.05	10	0.082	37.5	0.25	0.8	0.8	4	9	0.2	0.1
Pb	LW-06-A	0.82	0	1	0	0.0	*0.03*	0.0	0	0.02	0	0.02	10	0.082	31.1	0.25	0.6	0.7	4	9	0.2	0.1
Zn	LW-03-A	0.82	0	1	0	56	*56*	125	0	45.9	0	45.9	10	0.082	69.3	1	5.7	51.6	10	210	5.2	0.2
Zn	LW-03E-A	0.82	0	1	0	77	*77*	114	0	63.1	0	63.1	10	0.082	69.3	1	5.7	68.8	10	210	6.9	0.3
Zn	LW-04-A	0.82	0	1	0	89	*89*	55.5	0	73	0	73.0	10	0.082	158.8	1	13.0	86	10	210	8.6	0.4
Zn	LW-05-A	0.82	0	1	0	18	*18*	N/A	0	14.8	N/A	14.8	10	0.082	158.8	1	13.0	27.8	10	210	2.8	0.1
Zn	LW-06-A	0.82	0	1	0	31	*31*	73.2	0	25.4	0	25.4	10	0.082	129.3	1	10.6	36	10	210	3.6	0.2
Bayard Canyon																						
Cd	ERA-33	0.82	0	1	0	0.2	0.2	0.2	0	0	0	0.2	10	0.082	1.3	1	0.1	0.3	1.7	24	0.2	0.01
Cu	ERA-33	0.82	0	1	0	15.2	25.2	25	0	20.6	0	20.6	10	0.082	176.2	0.5	7.2	27.9	28	42	1.0	0.7
Pb	ERA-33	0.82	0	1	0	14.7	15.3	1.9	0	12.6	0	12.6	10	0.082	551.3	0.25	11.3	23.9	4	9	6.0	2.7
Zn	ERA-33	0.82	0	1	0	152	108.6	58	0	89.1	0	89.1	10	0.082	242.7	1	19.9	109.0	10	210	10.9	0.5

N/A: Not analyzed
Note: *Italicized* : Concentrations found in foliage were used as seed tissue concentrations.

Table 3.4-3
Hazard Quotient Calculations
Insectivorous Small Ground Feeding Bird
Hanover and Whitewater Creeks IU

Analyte	Location	Ignestion Rate Food (WW kg/kg BW/day)	Diet Composition Foliage (0%)	Diet Composition Seed (0%)	Diet Composition Invertebrate (100%)	Tissue Concentation (mg/kg) Foliage	Tissue Concentation (mg/kg) Seed	Tissue Concentation (mg/kg) Invertebrate	Food Exposure (mg/kg/day) Invertebrate	Food Exposure (mg/kg/day) Total	Percent of Diet as Soil	Ingestion Rate Soil (DW kg/kg BW/day)	Soil Concentration (mg/kg)	Availability Factor	Soil Exposure	Total Dose	Toxicity Reference Value NOAEL	Toxicity Reference Value LOAEL	Hazard Quotient NOAEL	Hazard Quotient LOAEL
Physical Reach 1																				
Cd	B45.8W	0.82	0	0	1	0.7	0.2	0.9	0.7	0.7	10	0.027	2.9	1	0.1	0.8	1.7	24	0.5	0.03
Cd	B47.2E	0.82	0	0	1	0.5	0.2	0.2	0.2	0.2	10	0.027	4	1	0.1	0.3	1.7	24	0.2	0.01
Cd	O43.5W	0.82	0	0	1	2.5	0.1	0.6	0.5	0.5	10	0.027	4.7	1	0.1	0.6	1.7	24	0.4	0.03
Cd	O44.2E	0.82	0	0	1	0.7	0.1	0.8	0.7	0.7	10	0.027	6	1	0.2	0.8	1.7	24	0.5	0.03
Cd	O48.8E	0.82	0	0	1	0.9	0.1	0.3	0.3	0.3	10	0.027	4.6	1	0.1	0.4	1.7	24	0.2	0.02
Cd	ERA-29	0.82	0	0	1	0.7	1.2	1.9	1.6	1.8	10	0.027	6	1	0.2	2.01	1.7	24	1.2	0.1
Cu	B45.8W	0.82	0	0	1	10.5	16.9	79.7	65.4	65.4	10	0.027	463	0.5	6.3	71.6	28	42	2.6	1.7
Cu	B47.2E	0.82	0	0	1	11.1	5.2	11.5	9.4	9.4	10	0.027	544	0.5	7.3	16.8	28	42	0.6	0.4
Cu	O43.5W	0.82	0	0	1	10.2	11.9	54.9	45.02	45.02	10	0.027	438	0.5	5.9	50.9	28	42	1.8	1.2
Cu	O44.2E	0.82	0	0	1	11.6	3.5	28.1	23.04	23.04	10	0.027	449	0.5	6.1	29.1	28	42	1.0	0.7
Cu	O48.8E	0.82	0	0	1	12.9	4.4	29.2	23.9	23.9	10	0.027	549	0.5	7.4	31.4	28	42	1.1	0.7
Cu	ERA-29	0.82	0	0	1	16.3	38.7	34.3	28.1	28.4	10	0.027	459.7	0.5	6.2	34.6	28	42	1.2	0.8
Pb	B45.8W	0.82	0	0	1	0.7	11.1	2.2	1.8	1.8	10	0.027	126	0.25	0.9	2.7	4	9	0.7	0.3
Pb	B47.2E	0.82	0	0	1	1.4	3.02	1.9	1.5	1.5	10	0.027	169	0.25	1.1	2.7	4	9	0.7	0.3
Pb	O43.5W	0.82	0	0	1	1.2	2.9	5.8	4.7	4.7	10	0.027	571	0.25	3.9	8.6	4	9	2.1	1.0
Pb	O44.2E	0.82	0	0	1	3.4	5.9	2.6	2.1	2.1	10	0.027	458	0.25	3.1	5.2	4	9	1.3	0.6
Pb	O48.8E	0.82	0	0	1	1.6	4.0	1.5	1.2	1.2	10	0.027	312	0.25	2.1	3.4	4	9	0.8	0.4
Pb	ERA-29	0.82	0	0	1	1.6	7.1	0.8	0.7	0.98	10	0.027	365.7	0.25	2.5	3.4	4	9	0.9	0.4
Zn	B45.8W	0.82	0	0	1	101	77.0	94.3	77.3	77.3	10	0.027	1220	1	32.9	110.3	10	210	11.0	0.5
Zn	B47.2E	0.82	0	0	1	112	23.6	42.9	35.2	35.2	10	0.027	1680	1	45.4	80.5	10	210	8.1	0.4
Zn	O43.5W	0.82	0	0	1	98	68	102	83.6	83.6	10	0.027	2040	1	55.1	138.7	10	210	13.9	0.7
Zn	O44.2E	0.82	0	0	1	152	28.7	90.4	74.1	74.1	10	0.027	2500	1	67.5	141.6	10	210	14.2	0.7
Zn	O48.8E	0.82	0	0	1	123	24.2	85.0	69.7	69.7	10	0.027	1930	1	52.1	121.8	10	210	12.2	0.6
Zn	ERA-29	0.82	0	0	1	250.8	216.2	83.8	68.7	69.01	10	0.027	2240	1	60.5	129.5	10	210	12.9	0.6
Physical Reach 2																				
Cd	ERA-32	0.82	0	0	1	1.7	1.5	0.5	0.4	0.7	10	0.027	19.1	1	0.5	1.2	1.7	24	0.7	0.1
Cu	ERA-32	0.82	0	0	1	42.3	34.7	33.9	27.8	28.1	10	0.027	419.5	0.5	5.7	33.8	28	42	1.2	0.8
Pb	ERA-32	0.82	0	0	1	40.6	17.2	4.6	3.8	4.1	10	0.027	2128	0.25	14.4	18.4	4	9	4.6	2.0
Zn	ERA-32	0.82	0	0	1	446	250.7	89.6	73.5	73.8	10	0.027	8350	1	225.4	299.2	10	210	29.9	1.4
Physical Reach 3																				
Cd	ERA-22	0.82	0	0	1	0.9	1.0	0.3	0.2	0.5	10	0.027	4.9	1	0.1	0.7	1.7	24	0.4	0.03
Cd	ERA-28	0.82	0	0	1	0.9	0.2	0.2	0.2	0.5	10	0.027	3.5	1	0.1	0.6	1.7	24	0.3	0.02
Cu	ERA-22	0.82	0	0	1	144	36.6	45.5	37.3	37.6	10	0.027	1120	0.5	15.1	52.7	28	42	1.9	1.3
Cu	ERA-28	0.82	0	0	1	42.6	30.8	56.4	46.2	46.5	10	0.027	1060	0.5	14.3	60.8	28	42	2.2	1.4
Pb	ERA-22	0.82	0	0	1	3.4	1.1	0.8	0.6	0.9	10	0.027	161.3	0.25	1.1	2	4	9	0.5	0.2
Pb	ERA-28	0.82	0	0	1	9.5	4.2	0.3	0.3	0.6	10	0.027	223	0.25	1.5	2.1	4	9	0.5	0.2
Zn	ERA-22	0.82	0	0	1	258	77.9	74.5	61.1	61.4	10	0.027	1520	1	41.04	102.4	10	210	10.2	0.5
Zn	ERA-28	0.82	0	0	1	254	85.4	98.7	80.9	81.2	10	0.027	1182	1	31.9	113.1	10	210	11.3	0.5
Physical Reach 5																				
Cd	ERA-23	0.82	0	0	1	0.2	0.5	0.5	0.4	0.7	10	0.027	1.6	1	0.04	0.7	1.7	24	0.4	0.03
Cd	ERA-26	0.82	0	0	1	0.1	0.1	0.1	0.1	0.4	10	0.027	0.6	1	0.01	0.4	1.7	24	0.2	0.02
Cu	ERA-23	0.82	0	0	1	70	23.9	51.3	42.1	42.4	10	0.027	973	0.5	13.1	55.5	28	42	2.0	1.3
Cu	ERA-26	0.82	0	0	1	72.8	46.2	90.4	74.1	74.4	10	0.027	535	0.5	7.2	81.7	28	42	2.9	1.9
Pb	ERA-23	0.82	0	0	1	2.1	7.2	0.2	0.1	0.4	10	0.027	21.4	0.25	0.1	0.6	4	9	0.1	0.1
Pb	ERA-26	0.82	0	0	1	0.88	1.3	0.2	0.1	0.4	10	0.027	13.7	0.25	0.1	0.5	4	9	0.1	0.1
Zn	ERA-23	0.82	0	0	1	25.3	40.7	43.3	35.5	35.8	10	0.027	35.6	1	1	36.8	10	210	3.7	0.2
Zn	ERA-26	0.82	0	0	1	32.3	39	22.3	18.3	18.6	10	0.027	18.1	1	0.5	19.1	10	210	1.9	0.1
Physical Reach 8																				
Cd	ERA-27	0.82	0	0	1	0.2	0.2	0.08	0.1	0.4	10	0.027	0.7	1	0.02	0.4	1.7	24	0.2	0.02
Cu	ERA-27	0.82	0	0	1	43.9	27.8	44.7	36.7	36.9	10	0.027	327.7	0.5	4.4	41.4	28	42	1.5	1.0
Pb	ERA-27	0.82	0	0	1	1.97	1.7	0.12	0.1	0.4	10	0.027	34.6	0.25	0.2	0.6	4	9	0.2	0.1
Zn	ERA-27	0.82	0	0	1	59.7	61	41	33.6	33.9	10	0.027	107.9	1	2.9	36.8	10	210	3.7	0.2
Side Channel Area											10									
Cd	SC-1	0.82	0	0	1	1	*1*	0.1	0.1	0.1	10	0.027	0.2	1	0.01	0.1	1.7	24	0.06	0.004
Cd	SC-2	0.82	0	0	1	2	*2*	0.2	0.2	0.2	10	0.027	0.2	1	0.01	0.2	1.7	24	0.10	0.01
Cd	SC-3	0.82	0	0	1	3.2	*3.2*	0.1	0.1	0.1	10	0.027	0.2	1	0.01	0.1	1.7	24	0.06	0.004
Cd	ERA-31	0.82	0	0	1	0.09	0.1	0.1	0.1	0.4	10	0.027	0.9	1	0.0	0.4	1.7	24	0.2	0.02
Cu	SC-1	0.82	0	0	1	25.1	*25.1*	49.3	40.4	40.4	10	0.027	192.3	0.5	2.6	43.0	28	42	1.5	1.02

Table 3.4-3
Hazard Quotient Calculations
Insectivorous Small Ground Feeding Bird
Hanover and Whitewater Creeks IU

			Diet Composition			Tissue Concentation (mg/kg)			Food Exposure (mg/kg/day)								Toxicity Reference Value		Hazard Quotient	
Analyte	Location	Ignestion Rate Food (WW kg/kg BW/day)	Foliage (0%)	Seed (0%)	Invertebrate (100%)	Foliage	Seed	Invertebrate	Invertebrate	Total	Percent of Diet as Soil	Ingestion Rate Soil (DW kg/kg BW/day)	Soil Concentration (mg/kg)	Availability Factor	Soil Exposure	Total Dose	NOAEL	LOAEL	NOAEL	LOAEL
Cu	SC-2	0.82	0	0	1	47.1	*47.1*	55.5	45.5	45.5	10	0.027	192.3	0.5	2.6	48.1	28	42	1.7	1.1
Cu	SC-3	0.82	0	0	1	47.4	*47.4*	32.8	26.9	26.9	10	0.027	192.3	0.5	2.6	29.5	28	42	1.1	0.7
Cu	ERA-31	0.82	0	0	1	9.3	12.3	19.1	15.7	16.0	10	0.027	77.8	0.5	1.05	17	28	42	0.6	0.4
Pb	SC-1	0.82	0	0	1	0.9	*0.9*	0.6	0.5	0.5	10	0.027	23.6	0.25	0.2	0.7	4	9	0.2	0.07
Pb	SC-2	0.82	0	0	1	1.6	*1.6*	0.1	0.04	0.04	10	0.027	23.6	0.25	0.2	0.2	4	9	0.05	0.02
Pb	SC-3	0.82	0	0	1	5.7	*5.7*	0.3	0.2	0.2	10	0.027	23.6	0.25	0.2	0.4	4	9	0.10	0.05
Pb	ERA-31	0.82	0	0	1	0.93	0.9	0.2	0.2	0.4	10	0.027	11.7	0.25	0.1	0.5	4	9	0.1	0.1
Zn	SC-1	0.82	0	0	1	65	*65*	42.4	34.8	34.8	10	0.027	94.2	1	2.5	37.3	10	210	3.7	0.18
Zn	SC-2	0.82	0	0	1	90	*90*	58.2	47.7	47.7	10	0.027	94.2	1	2.5	50.3	10	210	5.0	0.24
Zn	SC-3	0.82	0	0	1	123	*123*	40.7	33.4	33.4	10	0.027	94.2	1	2.5	35.9	10	210	3.6	0.17
Zn	ERA-31	0.82	0	0	1	21.2	39	42.4	34.8	35.1	10	0.027	37.9	1	1	36.1	10	210	3.6	0.2
Lower Whitewater Creek																				
Cd	LW-03-A	0.82	0	0	1	0.1	*0.1*	0.3	0.2	0.2	10	0.027	0.01	1	0.00027	0.2	1.7	24	0.1	0.01
Cd	LW-03E-A	0.82	0	0	1	1	*1*	0.2	0.1	0.1	10	0.027	0.01	1	0.0003	0.1	1.7	24	0.1	0.01
Cd	LW-04-A	0.82	0	0	1	0.3	*0.3*	0.1	0.1	0.1	10	0.027	0.5	1	0.01	0.1	1.7	24	0.1	0.004
Cd	LW-05-A	0.82	0	0	1	0.03	*0.03*	N/A	N/A	N/A	10	0.027	0.5	1	0.01	N/A	1.7	24	N/A	N/A
Cd	LW-06-A	0.82	0	0	1	0.1	*0.1*	0.2	0.1	0.1	10	0.027	0.5	1	0.01	0.1	1.7	24	0.1	0.01
Cu	LW-03-A	0.82	0	0	1	19	*19*	30.8	25.3	25.3	10	0.027	233	0.5	3.1	28.4	28	42	1.0	0.7
Cu	LW-03E-A	0.82	0	0	1	35	*35*	21.1	17.3	17.3	10	0.027	233	0.5	3.1	20.4	28	42	0.7	0.5
Cu	LW-04-A	0.82	0	0	1	33	*33*	78	64	64	10	0.027	954.2	0.5	12.9	76.8	28	42	2.7	1.8
Cu	LW-05-A	0.82	0	0	1	14	*14*	N/A	N/A	N/A	10	0.027	954.2	0.5	12.9	N/A	28	42	N/A	N/A
Cu	LW-06-A	0.82	0	0	1	18	*18*	41.4	33.9	33.9	10	0.027	271.2	0.5	3.7	37.6	28	42	1.3	0.9
Pb	LW-03-A	0.82	0	0	1	0.2	*0.2*	2.2	1.8	1.8	10	0.027	21.2	0.25	0.1	1.9	4	9	0.5	0.2
Pb	LW-03E-A	0.82	0	0	1	1	*1*	0.4	0.3	0.3	10	0.027	21.2	0.25	0.1	0.5	4	9	0.1	0.1
Pb	LW-04-A	0.82	0	0	1	0.1	*0.1*	0.5	0.4	0.4	10	0.027	37.5	0.25	0.3	0.6	4	9	0.2	0.1
Pb	LW-05-A	0.82	0	0	1	0.1	*0.1*	N/A	N/A	N/A	10	0.027	37.5	0.25	0.3	N/A	4	9	N/A	N/A
Pb	LW-06-A	0.82	0	0	1	0.03	*0.03*	0.01	0.01	0.0	10	0.027	31.1	0.25	0.2	0.2	4	9	0.1	0.02
Zn	LW-03-A	0.82	0	0	1	56	*56*	125	102.5	102.5	10	0.027	69.3	1	1.9	104.4	10	210	10.4	0.5
Zn	LW-03E-A	0.82	0	0	1	77	*77*	114	93.5	93.5	10	0.027	69.3	1	1.9	95.4	10	210	9.5	0.5
Zn	LW-04-A	0.82	0	0	1	89	*89*	55.5	45.5	45.5	10	0.027	158.8	1	4.3	49.8	10	210	5.0	0.2
Zn	LW-05-A	0.82	0	0	1	18	*18*	N/A	N/A	N/A	10	0.027	158.8	1	4.3	N/A	10	210	N/A	N/A
Zn	LW-06-A	0.82	0	0	1	31	*31*	73.2	60	60	10	0.027	129.3	1	3.5	63.5	10	210	6.4	0.3
Bayard Canyon																				
Cd	ERA-33	0.82	0	0	1	0.2	0.2	0.2	0.1	0.4	10	0.027	1.3	1	0.04	0.5	1.7	24	0.3	0.02
Cu	ERA-33	0.82	0	0	1	15.2	25.2	25	20.5	20.8	10	0.027	176.2	0.5	2.4	23.2	28	42	0.8	0.6
Pb	ERA-33	0.82	0	0	1	14.7	15.3	1.9	1.6	1.8	10	0.027	551.3	0.25	3.7	5.6	4	9	1.4	0.6
Zn	ERA-33	0.82	0	0	1	152	108.6	58	47.6	47.9	10	0.027	242.7	1	6.6	54.4	10	210	5.4	0.3

N/A: Not analyzed
Note: *Italicized*: Concentrations found in foliage were used as seed tissue concentrations.

Table 3.4-4
Hazard Quotient Calculations
Small Mammal
Hanover and Whitewater Creeks IU

Analyte	Location	Ignestion Rate Food (WW kg/kg BW/day)	Diet Composition: Foliage (11 %)	Diet Composition: Seed (43%)	Diet Composition: Invertebrate (46%)	Tissue Concentation (mg/kg): Foliage	Tissue Concentation (mg/kg): Seed	Tissue Concentation (mg/kg): Invertebrate	Food Exposure (mg/kg/day): Foliage	Food Exposure (mg/kg/day): Seed	Food Exposure (mg/kg/day): Invertebrate	Food Exposure (mg/kg/day): Total	Percent of Diet as Soil	Ingestion Rate Soil (DW kg/kg BW/day)	Soil Concentration (mg/kg)	Availability Factor	Soil Exposure	Total Dose	Toxicity Reference Value: NOAEL	Toxicity Reference Value: LOAEL	Hazard Quotient: NOAEL	Hazard Quotient: LOAEL
Physical Reach 1																						
Cd	B45.8W	0.21	0.11	0.43	0.46	0.7	0.2	0.9	0.02	0.02	0.09	0.1	2	0.0038	2.9	1	0.01	0.1	1.7	24	0.1	0.01
Cd	B47.2E	0.21	0.11	0.43	0.46	0.5	0.2	0.2	0.01	0.02	0.02	0.05	2	0.0038	4.0	1	0.02	0.1	1.7	24	0.04	0.003
Cd	O43.5W	0.21	0.11	0.43	0.46	2.5	0.1	0.6	0.06	0.01	0.06	0.1	2	0.0038	4.7	1	0.02	0.1	1.7	24	0.1	0.01
Cd	O44.2E	0.21	0.11	0.43	0.46	0.7	0.1	0.8	0.02	0.01	0.08	0.1	2	0.0038	6.0	1	0.02	0.1	1.7	24	0.1	0.01
Cd	O48.8E	0.21	0.11	0.43	0.46	0.9	0.1	0.3	0.02	0.01	0.03	0.1	2	0.0038	4.6	1	0.02	0.1	1.7	24	0.05	0.003
Cd	ERA-29	0.21	0.11	0.43	0.46	0.7	1.2	1.9	0.02	0.11	0.18	0.3	2	0.0038	6.0	1	0.02	0.3	1.7	24	0.2	0.01
Cu	B45.8W	0.21	0.11	0.43	0.46	10.5	16.9	79.7	0.2	1.5	7.7	9.5	2	0.0038	463	0.5	0.9	10.3	28	42	0.4	0.2
Cu	B47.2E	0.21	0.11	0.43	0.46	11.1	5.2	11.5	0.3	0.5	1.1	1.8	2	0.0038	544	0.5	1.0	2.9	28	42	0.1	0.1
Cu	O43.5W	0.21	0.11	0.43	0.46	10.2	11.9	54.9	0.2	1.07	5.3	6.6	2	0.0038	438	0.5	0.8	7.4	28	42	0.3	0.2
Cu	O44.2E	0.21	0.11	0.43	0.46	11.6	3.5	28.1	0.3	0.3	2.7	3.3	2	0.0038	449	0.5	0.9	4.2	28	42	0.1	0.1
Cu	O48.8E	0.21	0.11	0.43	0.46	12.9	4.42	29.2	0.3	0.40	2.8	3.5	2	0.0038	549	0.5	1.0	4.6	28	42	0.2	0.1
Cu	ERA-29	0.21	0.11	0.43	0.46	16.3	38.7	34.3	0.4	3.5	3.3	7.2	2	0.0038	459.7	0.5	0.9	8.1	28	42	0.3	0.2
Pb	B45.8W	0.21	0.11	0.43	0.46	0.73	11.1	2.2	0.02	1.0	0.2	1.2	2	0.0038	126	0.25	0.1	1.4	4	9	0.3	0.2
Pb	B47.2E	0.21	0.11	0.43	0.46	1.4	3.02	1.9	0.03	0.3	0.2	0.5	2	0.0038	169	0.25	0.2	0.6	4	9	0.2	0.1
Pb	O43.5W	0.21	0.11	0.43	0.46	1.2	2.9	5.8	0.03	0.3	0.6	0.8	2	0.0038	571	0.25	0.5	1.4	4	9	0.3	0.2
Pb	O44.2E	0.21	0.11	0.43	0.46	3.4	5.9	2.6	0.08	0.5	0.2	0.9	2	0.0038	458	0.25	0.4	1.3	4	9	0.3	0.1
Pb	O48.8E	0.21	0.11	0.43	0.46	1.6	4	1.5	0.04	0.4	0.1	0.5	2	0.0038	312	0.25	0.3	0.8	4	9	0.2	0.1
Pb	ERA-29	0.21	0.11	0.43	0.46	1.6	7.1	0.8	0.04	0.6	0.1	0.8	2	0.0038	365.7	0.25	0.3	1.1	4	9	0.3	0.1
Zn	B45.8W	0.21	0.11	0.43	0.46	101	77	94.3	2.3	7.0	9.1	18.4	2	0.0038	1220	1	4.6	23.0	10	210	2.3	0.1
Zn	B47.2E	0.21	0.11	0.43	0.46	112	23.6	42.9	2.6	2.1	4.1	8.9	2	0.0038	1680	1	6.4	15.2	10	210	1.5	0.1
Zn	O43.5W	0.21	0.11	0.43	0.46	98	68	102	2.3	6.1	9.9	18.3	2	0.0038	2040	1	7.8	26.0	10	210	2.6	0.1
Zn	O44.2E	0.21	0.11	0.43	0.46	152	28.7	90.4	3.5	2.6	8.7	14.8	2	0.0038	2500	1	9.5	24.3	10	210	2.4	0.1
Zn	O48.8E	0.21	0.11	0.43	0.46	123	24.2	85	2.8	2.2	8.2	13.2	2	0.0038	1930	1	7.3	20.6	10	210	2.1	0.1
Zn	ERA-29	0.21	0.11	0.43	0.46	250.8	216.2	83.8	5.8	19.5	8.1	33.4	2	0.0038	2240	1	8.5	41.9	10	210	4.2	0.2
Physical Reach 2																						
Cd	ERA-32	0.21	0.11	0.43	0.46	1.7	1.5	0.5	0.04	0.13	0.05	0.2	2	0.0038	19.1	1	0.1	0.3	1.7	24	0.2	0.01
Cu	ERA-32	0.21	0.11	0.43	0.46	42.3	34.7	33.9	1.0	3.1	3.3	7.4	2	0.0038	419.5	0.5	0.8	8.2	28	42	0.3	0.2
Pb	ERA-32	0.21	0.11	0.43	0.46	40.6	17.2	4.6	0.9	1.6	0.4	2.9	2	0.0038	2128	0.25	2.0	5.0	4	9	1.2	0.6
Zn	ERA-32	0.21	0.11	0.43	0.46	446	250.7	89.6	10.3	22.6	8.7	41.6	2	0.0038	8349.7	1	31.7	73.3	10	210	7.3	0.3
Physical Reach 3																						
Cd	ERA-22	0.21	0.11	0.43	0.46	0.9	1.0	0.3	0.02	0.09	0.03	0.1	2	0.0038	4.9	1	0.02	0.2	1.7	24	0.1	0.01
Cd	ERA-28	0.21	0.11	0.43	0.46	0.9	0.2	0.2	0.02	0.02	0.02	0.1	2	0.0038	3.5	1	0.01	0.1	1.7	24	0.04	0.003
Cu	ERA-22	0.21	0.11	0.43	0.46	144	36.6	45.5	3.3	3.3	4.4	11.02	2	0.0038	1120	0.5	2.1	13.2	28	42	0.5	0.3
Cu	ERA-28	0.21	0.11	0.43	0.46	42.6	30.8	56.4	1.0	2.8	5.4	9.2	2	0.0038	1060	0.5	2.0	11.2	28	42	0.4	0.3
Pb	ERA-22	0.21	0.11	0.43	0.46	3.4	1.1	0.8	0.1	0.1	0.1	0.3	2	0.0038	161.3	0.25	0.2	0.4	4	9	0.1	0.05
Pb	ERA-28	0.21	0.11	0.43	0.46	9.5	4.2	0.3	0.2	0.4	0.03	0.6	2	0.0038	223	0.25	0.2	0.8	4	9	0.2	0.1
Zn	ERA-22	0.21	0.11	0.43	0.46	258	77.9	74.5	6.0	7.0	7.2	20.2	2	0.0038	1520	1	5.8	26.0	10	210	2.6	0.1
Zn	ERA-28	0.21	0.11	0.43	0.46	254	85.4	98.7	5.9	7.7	9.5	23.1	2	0.0038	1181.7	1	4.5	27.6	10	210	2.8	0.1
Physical Reach 5																						
Cd	ERA-23	0.21	0.11	0.43	0.46	0.2	0.5	0.5	0.005	0.04	0.05	0.1	2	0.0038	1.6	1	0.01	0.1	1.7	24	0.1	0.004
Cd	ERA-26	0.21	0.11	0.43	0.46	0.1	0.1	0.1	0.003	0.01	0.01	0.02	2	0.0038	0.6	1	0.002	0.0	1.7	24	0.0	0.001
Cu	ERA-23	0.21	0.11	0.43	0.46	70	23.9	51.3	1.6	2.2	5.0	8.7	2	0.0038	973	0.5	1.8	10.6	28	42	0.4	0.3
Cu	ERA-26	0.21	0.11	0.43	0.46	72.8	46.2	90.4	1.7	4.2	8.7	14.6	2	0.0038	535	0.5	1.0	15.6	28	42	0.6	0.4
Pb	ERA-23	0.21	0.11	0.43	0.46	2.1	7.2	0.2	0.05	0.7	0.02	0.7	2	0.0038	21.4	0.25	0.02	0.7	4	9	0.2	0.1
Pb	ERA-26	0.21	0.11	0.43	0.46	0.9	1.3	0.2	0.02	0.1	0.02	0.2	2	0.0038	13.7	0.25	0.01	0.2	4	9	0.04	0.02
Zn	ERA-23	0.21	0.11	0.43	0.46	25.3	40.7	43.3	0.6	3.7	4.2	8.4	2	0.0038	35.6	1	0.1	8.6	10	210	0.9	0.04
Zn	ERA-26	0.21	0.11	0.43	0.46	32.3	39.0	22.3	0.7	3.5	2.2	6.4	2	0.0038	18.1	1	0.1	6.5	10	210	0.6	0.03
Physical Reach 8																						
Cd	ERA-27	0.21	0.11	0.43	0.46	0.2	0.2	0.1	0.01	0.01	0.01	0.03	2	0.0038	0.7	1	0.003	0.0	1.7	24	0.02	0.001
Cu	ERA-27	0.21	0.11	0.43	0.46	43.9	27.8	44.7	1.0	2.5	4.3	7.8	2	0.0038	327.7	0.5	0.6	8.5	28	42	0.3	0.2
Pb	ERA-27	0.21	0.11	0.43	0.46	2.0	1.7	0.1	0.05	0.2	0.01	0.2	2	0.0038	34.6	0.25	0.03	0.2	4	9	0.1	0.03
Zn	ERA-27	0.21	0.11	0.43	0.46	59.7	61.0	41.0	1.4	5.5	4.0	10.9	2	0.0038	107.9	1	0.4	11.3	10	210	1.1	0.1
Side Channel Area																						
Cd	SC-1	0.21	0.11	0.43	0.46	1.0	*1.0*	0.1	0.02	0.1	0.01	0.1	2	0.0038	0.2	1	0.001	0.1	1.7	24	0.1	0.01
Cd	SC-2	0.21	0.11	0.43	0.46	2.0	*2.0*	0.2	0.05	0.2	0.02	0.2	2	0.0038	0.2	1	0.001	0.2	1.7	24	0.1	0.01
Cd	SC-3	0.21	0.11	0.43	0.46	3.2	*3.2*	0.1	0.1	0.3	0.01	0.4	2	0.0038	0.2	1	0.001	0.4	1.7	24	0.2	0.02
Cd	ERA-31	0.21	0.11	0.43	0.46	0.1	0.1	0.1	0.002	0.01	0.01	0.02	2	0.0038	0.9	1	0.003	0.02	1.7	24	0.01	0.001
Cu	SC-1	0.21	0.11	0.43	0.46	25.1	*25.1*	49.3	0.6	2.3	4.8	7.6	2	0.0038	192.3	0.5	0.4	8.0	28	42	0.3	0.2
Cu	SC-2	0.21	0.11	0.43	0.46	47.1	*47.1*	55.5	1.1	4.3	5.4	10.7	2	0.0038	192.3	0.5	0.4	11.1	28	42	0.4	0.3

Table 3.4-4
Hazard Quotient Calculations
Small Mammal
Hanover and Whitewater Creeks IU

			Diet Composition			Tissue Concentation (mg/kg)			Food Exposure (mg/kg/day)										Toxicity Reference Value		Hazard Quotient	
Analyte	Location	Ignestion Rate Food (WW kg/kg BW/day)	Foliage (11 %)	Seed (43%)	Invertebrate (46%)	Foliage	Seed	Invertebrate	Foliage	Seed	Invertebrate	Total	Percent of Diet as Soil	Ingestion Rate Soil (DW kg/kg BW/day)	Soil Concentration (mg/kg)	Availability Factor	Soil Exposure	Total Dose	NOAEL	LOAEL	NOAEL	LOAEL
Cu	SC-3	0.21	0.11	0.43	0.46	47.4	*47.4*	32.8	1.1	4.3	3.2	8.5	2	0.0038	192.3	0.5	0.4	8.9	28	42	0.3	0.2
Cu	ERA-31	0.21	0.11	0.43	0.46	9.3	12.3	19.1	0.2	1.1	1.8	3.2	2	0.0038	77.8	0.5	0.1	3.3	28	42	0.1	0.1
Pb	SC-1	0.21	0.11	0.43	0.46	0.9	*0.9*	0.6	0.02	0.1	0.1	0.2	2	0.0038	23.6	0.25	0.02	0.2	4	9	0.04	0.02
Pb	SC-2	0.21	0.11	0.43	0.46	1.6	*1.6*	0.1	0.04	0.1	0.005	0.2	2	0.0038	23.6	0.25	0.02	0.2	4	9	0.1	0.02
Pb	SC-3	0.21	0.11	0.43	0.46	5.7	*5.7*	0.3	0.1	0.5	0.03	0.7	2	0.0038	23.6	0.25	0.02	0.7	4	9	0.2	0.1
Pb	ERA-31	0.21	0.11	0.43	0.46	0.9	0.9	0.2	0.02	0.1	0.0	0.1	2	0.0038	11.7	0.25	0.01	0.1	4	9	0.03	0.01
Zn	SC-1	0.21	0.11	0.43	0.46	65	*65*	42.4	1.5	5.9	4.1	11.5	2	0.0038	94.2	1	0.4	11.8	10	210	1.2	0.1
Zn	SC-2	0.21	0.11	0.43	0.46	90	*90*	58.2	2.1	8.1	5.6	15.8	2	0.0038	94.2	1	0.4	16.2	10	210	1.6	0.1
Zn	SC-3	0.21	0.11	0.43	0.46	123	*123*	40.7	2.8	11.1	3.9	17.9	2	0.0038	94.2	1	0.4	18.2	10	210	1.8	0.1
Zn	ERA-31	0.21	0.11	0.43	0.46	21.2	39.0	42.4	0.5	3.5	4.1	8.1	2	0.0038	37.9	1	0.1	8.2	10	210	0.8	0.04
Lower Whitewater Creek																						
Cd	LW-03-A	0.21	0.11	0.43	0.46	0.1	*0.1*	0.3	0.003	0.0	0.03	0.04	2	0.0038	0.01	1	0.00004	0.04	1.7	24	0.03	0.002
Cd	LW-03E-A	0.21	0.11	0.43	0.46	0.6	*0.6*	0.2	0.01	0.1	0.02	0.08	2	0.0038	0.01	1	0.00004	0.08	1.7	24	0.05	0.003
Cd	LW-04-A	0.21	0.11	0.43	0.46	0.3	*0.3*	0.1	0.01	0.03	0.01	0.04	2	0.0038	0.5	1	0.002	0.05	1.7	24	0.03	0.002
Cd	LW-05-A	0.21	0.11	0.43	0.46	0.03	*0.03*	N/A	0.001	0.002	N/A	0.003	2	0.0038	0.5	1	0.002	0.005	1.7	24	0.003	0.0002
Cd	LW-06-A	0.21	0.11	0.43	0.46	0.1	*0.1*	0.2	0.002	0.009	0.01	0.03	2	0.0038	0.5	1	0.002	0.03	1.7	24	0.02	0.001
Cu	LW-03-A	0.21	0.11	0.43	0.46	19.3	*19.3*	30.8	0.4	1.7	3.0	5.2	2	0.0038	233	0.5	0.44	5.61	28	42	0.2	0.1
Cu	LW-03E-A	0.21	0.11	0.43	0.46	34.5	*34.5*	21.1	0.8	3.1	2.0	6.0	2	0.0038	233	0.5	0.44	6.39	28	42	0.2	0.2
Cu	LW-04-A	0.21	0.11	0.43	0.46	32.7	*32.7*	78	0.8	3.0	7.5	11.2	2	0.0038	954.2	0.5	1.81	13.06	28	42	0.5	0.3
Cu	LW-05-A	0.21	0.11	0.43	0.46	14	*14*	N/A	0.3	1.3	N/A	1.6	2	0.0038	954.2	0.5	1.81	3.4	28	42	0.1	0.08
Cu	LW-06-A	0.21	0.11	0.43	0.46	17.6	*17.6*	41.4	0.4	1.6	4.0	6.00	2	0.0038	271.2	0.5	0.52	6.5	28	42	0.2	0.2
Pb	LW-03-A	0.21	0.11	0.43	0.46	0.2	*0.2*	2.2	0.01	0.0	0.2	0.2	2	0.0038	21.2	0.25	0.02	0.26	4	9	0.06	0.03
Pb	LW-03E-A	0.21	0.11	0.43	0.46	0.7	*0.7*	0.4	0.02	0.1	0.04	0.1	2	0.0038	21.2	0.25	0.02	0.14	4	9	0.03	0.02
Pb	LW-04-A	0.21	0.11	0.43	0.46	0.1	*0.1*	0.5	0.001	0.005	0.05	0.05	2	0.0038	37.5	0.25	0.04	0.09	4	9	0.02	0.01
Pb	LW-05-A	0.21	0.11	0.43	0.46	0.1	*0.1*	N/A	0.001	0.005	N/A	N/A	2	0.0038	37.5	0.25	0.04	N/A	4	9	N/A	N/A
Pb	LW-06-A	0.21	0.11	0.43	0.46	0.03	*0.03*	0.01	0.001	0.002	0.001	0.004	2	0.0038	31.08	0.25	0.03	0.03	4	9	0.01	0.004
Zn	LW-03-A	0.21	0.11	0.43	0.46	56	*56*	125	1.3	5.1	12.1	18.4	2	0.0038	69.3	1	0.3	18.7	10	210	1.9	0.09
Zn	LW-03E-A	0.21	0.11	0.43	0.46	77	*77*	114	1.8	7.0	11.0	19.7	2	0.0038	69.3	1	0.3	20.01	10	210	2.0	0.1
Zn	LW-04-A	0.21	0.11	0.43	0.46	89	*89*	55.5	2.1	8.0	5.4	15.5	2	0.0038	158.8	1	0.6	16.06	10	210	1.6	0.08
Zn	LW-05-A	0.21	0.11	0.43	0.46	18	*18*	N/A	0.4	1.6	N/A	N/A	2	0.0038	158.8	1	0.6	N/A	10	210	N/A	N/A
Zn	LW-06-A	0.21	0.11	0.43	0.46	31	*31*	73.2	0.7	2.8	7.1	10.6	2	0.0038	129.3	1	0.5	11.08	10	210	1.1	0.05
Bayard Canyon																						
Cd	ERA-33	0.21	0.11	0.43	0.46	0.2	0.2	0.2	0.00	0.02	0.02	0.04	2	0.0038	1.3	1	0.005	0.05	1.7	24	0.03	0.002
Cu	ERA-33	0.21	0.11	0.43	0.46	15.2	25.2	25.0	0.4	2.3	2.4	5.04	2	0.0038	176.2	0.5	0.3	5.4	28	42	0.2	0.1
Pb	ERA-33	0.21	0.11	0.43	0.46	14.7	15.3	1.9	0.3	1.4	0.2	1.9	2	0.0038	551.3	0.25	0.5	2.4	4	9	0.6	0.3
Zn	ERA-33	0.21	0.11	0.43	0.46	152.0	108.6	58	3.5	9.8	5.6	18.9	2	0.0038	242.7	1	0.9	19.8	10	210	2.0	0.1

N/A: Not analyzed
Note: *Italicized* : Concentrations found in foliage were used as seed tissue concentrations.

Table 4.1-1
Comparison of Summer Rainfall Pool Data to Amphibian TRVs and NMWQCs
Hanover and Whitewater Creeks Investigation Unit

Parameter **Hardness (Calculated - mg/L)**	**HC-51.6** **2006** **1450**	**U02-9100** **1999** **1740**	**WWC-38.1** **2006** **1600**	**U03-9200** **1999** **1314**	**U03-9000** **1999** **86.2**	**LUCKY BILL U/S NO.5** **2007** **126**	**LUCKY BILL AT NO.5** **2007** **158**	**Lucky Bill Mouth** **2007** **180**	**BAYARD/LB CON** **2007** **172**	**BAYARD CANYON D/S** **2007** **155**	**BAYARD CANYON U/S** **2007** **179**	**BAYARD CANYON MID** **2007** **143**	**U03-9001** **1999** **168.4**	**U03-9002** **1999** **35.9**	**BFT-1** **2006** **22.9**	**BC-1** **2007** **169**
Cadmium, dissolved	0.004	0.013	0.010	0.007	N/D	N/D	0.00019 J	0.00007 J	0.00042 J	0.0027 J	0.0044 J	0.0033 J	0.0044	N/D	N/D	0.001
Amphibian (1)	**0.004**	**0.004**	**0.004**	**0.004**	0.004	0.004	0.004	0.004	0.004	0.004	**0.004**	0.004	**0.004**	0.004	0.004	0.004
Acute Criteria (2)	0.027	0.032	0.030	0.025	0.002	0.003	0.003	0.004	0.003	0.003	**0.004**	**0.003**	**0.003**	0.0007	0.0005	0.0034
Chronic Criteria (2)	**0.002**	**0.002**	**0.002**	**0.001**	0.0002	0.0003	0.0003	0.0004	**0.0004**	**0.0003**	**0.0004**	**0.0003**	**0.0004**	0.0001	8.8E-05	**0.0004**
Chromium, dissolved	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
Amphibian (1)	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Acute Criteria (2)	5.09	5.91	5.52	4.70	0.50	0.83	0.69	0.92	0.89	0.82	0.92	0.76	0.87	0.25	0.17	0.88
Chronic Criteria (2)	0.66	0.77	0.72	0.61	0.07	0.11	0.09	0.12	0.12	0.11	0.12	0.10	0.11	0.03	0.02	0.11
Copper, dissolved	0.01	0.014 J	0.21	0.01	0.009	0.002 J	0.003 J	0.002 J	0.004 J	0.03	0.03	0.03	0.05	0.02	0.02	0.03
Amphibian (1)	0.02	0.02	**0.02**	0.02	0.02	0.02	0.02	0.02	0.02	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**
Acute Criteria (2)	0.17	0.20	**0.18**	0.15	0.01	0.02	0.02	0.02	0.02	**0.02**	**0.02**	**0.02**	**0.02**	**0.01**	**0.00**	**0.02**
Chronic Criteria (2)	0.09	0.10	**0.10**	0.08	**0.01**	0.01	0.01	0.02	0.01	**0.01**	**0.02**	**0.01**	**0.01**	**0.00**	**0.00**	**0.01**
Lead, dissolved	0.0002	N/D	0.0006	N/D	N/D	N/D	N/D	N/D	0.0017 J	0.002 J	0.0037 J	0.0032 J	0.011	N/D	0.00017	0.0014
Amphibian (1)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	**0.005**	0.005	0.005	0.005
Acute Criteria (2)	0.99	1.16	1.08	0.90	0.05	0.11	0.08	0.12	0.12	0.10	0.12	0.10	0.11	0.02	0.01	0.11
Chronic Criteria (2)	0.04	0.05	0.04	0.04	0.002	0.004	0.003	0.005	0.005	0.004	0.005	0.004	**0.004**	0.001	0.0005	0.004
Molybdenum, dissolved	0.04	0.03	0.01	N/D	N/D	0.011	0.01	0.01	0.01	0.01	0.01	0.01	N/D	N/D	N/D	0.008
Amphibian (1)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Acute Criteria (2)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chronic Criteria (2)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium, total	0.002	N/D	0.002	N/D	N/D	0.0004 J	0.0003 J	0.0005 J	0.0004 J	0.0007 J	0.0006 J	0.0005 J	N/D	N/D	0.0006	0.001
Amphibian (1)																
Acute Criteria (2)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Chronic Criteria (2)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Zinc, dissolved	1.38	2.16	1.72 J	0.484	N/D	N/D	0.089	0.015	0.14	0.28	0.374	0.354	0.358	N/D	N/D	0.103
Amphibian (1)	**0.2**	**0.2**	**0.2**	**0.2**	0.2	0.2	0.2	0.2	0.2	**0.2**	**0.2**	**0.2**	**0.2**	0.2	0.2	0.2
Acute Criteria (2)	**1.13**	**1.32**	**1.23**	1.04	0.10	0.17	0.14	0.19	0.19	**0.17**	**0.19**	**0.16**	**0.18**	0.05	0.03	0.18
Chronic Criteria (2)	**1.14**	**1.33**	**1.24**	1.05	0.10	0.17	0.14	0.19	0.19	**0.17**	**0.19**	**0.16**	**0.18**	0.05	0.03	0.18

J: Result estimated
N/D: Result non-detected
Notes:
(1) No-Effect Concentration based on data presented in Harfenist et al. 1989 or derived in TM-1 (Schafer and Associates 1999)

(2) Calculated with equation 1b or 2a of 20.6.4.900(I) NMAC; As Amended thorugh July 17, 2005.
Bold - Detected concentration is greater than the TRV
Hardness calculations presented on Table B-1 (Appendix B of this document)

Table 4.1-1
Comparison of Summer Rainfall Pool Data to Amphibian TRVs and NMWQCs
Hanover and Whitewater Creeks Investigation Unit

Parameter Hardness (Calculated - mg/L)	U03-9300	WWC-29.7	U03-9302	WWC-28.6	U03-9301	GRUNERUD-1	B-RANCH	U03-9500	U03-9600	WWC-H180	U03-9900	LWWC-1	LWWCR.RANCHERS POND
	1999	2006	1999	2006	1999	2006	2006	1999	1999	2006	1999	2006	2007
	75.7	515	740.7	1460	79	1820	1770	109	431.5	725	225.1	347	228
Cadmium, dissolved	0.00022 J	0.001	0.013	0.009	N/D	0.027	0.034	0.002	0.037 J	0.011	0.001	0.005	0.00007 J
Amphibian (1)	0.004	0.004	**0.004**	**0.004**	0.004	**0.004**	**0.004**	0.004	**0.004**	**0.004**	0.004	**0.004**	0.004
Acute Criteria (2)	0.002	0.010	0.014	0.027	0.002	0.034	**0.033**	**0.002**	**0.008**	0.014	0.0044	0.007	0.005
Chronic Criteria (2)	**0.0002**	**0.0008**	**0.0010**	**0.0016**	0.0002	**0.002**	**0.002**	**0.0003**	**0.0007**	**0.001**	**0.0004**	**0.0006**	0.0004
Chromium, dissolved	N/D	N/D	N/D	N/D	N/D	N/D	0.00042	N/D	N/D	N/D	0.0077	N/D	N/D
Amphibian (1)	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	**0.003**	0.003	0.003
Acute Criteria (2)	0.45	2.18	2.94	5.12	0.47	6.13	5.99	0.61	1.89	2.89	1.11	1.58	1.12
Chronic Criteria (2)	0.06	0.28	0.38	0.67	0.06	0.80	0.78	0.08	0.25	0.38	0.14	0.21	0.15
Copper, dissolved	0.05	0.31	0.84	0.14	0.03	1.22	2.34	0.09	0.6	0.48	0.05	0.55	0.02
Amphibian (1)	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**
Acute Criteria (2)	**0.01**	**0.06**	**0.09**	0.17	**0.01**	**0.21**	**0.20**	**0.02**	**0.05**	**0.09**	**0.03**	**0.04**	0.03
Chronic Criteria (2)	**0.01**	**0.04**	**0.05**	**0.09**	**0.01**	**0.11**	**0.10**	**0.01**	**0.03**	**0.05**	**0.02**	**0.03**	**0.02**
Lead, dissolved	N/D	0.0003	N/D	0.0004	N/D	0.0057	0.008	N/D	N/D	0.0001	N/D	0.0001	N/D
Amphibian (1)	0.005	0.005	0.005	0.005	0.005	**0.005**	**0.005**	0.005	0.005	0.005	0.005	0.005	0.005
Acute Criteria (2)	0.05	0.36	0.52	0.99	0.05	1.21	1.18	0.07	0.30	0.51	0.15	0.24	0.16
Chronic Criteria (2)	0.002	0.014	0.02	0.039	0.002	0.047	0.046	0.003	0.012	0.020	0.006	0.009	0.006
Molybdenum, dissolved	N/D	0.008	N/D	0.003	N/D	0.006	0.005	N/D	N/D	0.004	N/D	0.003	0.008 J
Amphibian (1)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Acute Criteria (2)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chronic Criteria (2)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium, total	N/D	0.002	N/D	0.003	N/D	0.003	0.004	N/D	N/D	0.002	N/D	0.0009	0.001 J
Amphibian (1)													
Acute Criteria (2)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Chronic Criteria (2)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Zinc, dissolved	0.029	0.21	3.42	1.67	N/D	5.84	7.89	0.017	1.06	1.6	0.037	0.90	N/D
Amphibian (1)	0.2	**0.2**	**0.2**	**0.2**	0.2	**0.2**	**0.2**	0.2	**0.2**	**0.2**	0.2	**0.2**	0.2
Acute Criteria (2)	0.09	0.47	**0.64**	**1.14**	0.1	**1.37**	**1.34**	0.13	**0.40**	**0.63**	0.23	**0.34**	0.24
Chronic Criteria (2)	0.09	0.47	**0.64**	**1.15**	0.1	**1.38**	**1.35**	0.13	**0.41**	**0.63**	0.23	**0.34**	0.24

J: Result estimated
N/D: Result non-detected
Notes:
(1) No-Effect Concentration based on data presented in Harfenist et al. 1989 or derived in TM-1 (Schafer and Associates 1999)

(2) Calculated with equation 1b or 2a of 20.6.4.900(I) NMAC; As Amended thorugh July 17, 2005.
Bold - Detected concentration is greater than the TRV
Hardness calculations presented on Table B-1 (Appendix B of this document)

Table 4.2-1
Comparison of Sediment Concentrations to TRVs
Hanover and Whitewater Creeks Investigation Unit

Parameter	GA12	GA31	GA50	LW-03E-S01-SD	LW-03E-S02-SD	LW-03E-S03-SD	LW-03E-S04-SD	LW-03E-S05-SD	U02-1100	U02-1102	U02-1103	U02-1105	U02-5001
Cadmium	N/D	0.5	0.75	0.50	1.06	0.95	1.00	0.69	7.55 J	6.05 J	1.59 J	1.79 J	7.60
Threshold Effects Concentration	0.99	0.99	0.99	0.99	**0.99**	0.99	**0.99**	0.99	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**
Probable Effects Concentration	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	**4.98**	**4.98**	4.98	4.98	**4.98**
Chromium	8.8	19.6	15.6	10.1	12.7	20.6	12.7	12.1	11.0	14.3	N/D	10.3	8.80
Threshold Effects Concentration	43	43	43	43	43	43	43	43	43	43	43	43	43
Probable Effects Concentration	110	110	110	110	110	110	110	110	110	110	110	110	110
Copper	98.5	199	435	439	779	756	542	731	297	371	378	366	926
Threshold Effects Concentration	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**
Probable Effects Concentration	149	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**
Lead	10.6	23	50.7	24.5	30.9	40.7	32.6	27.5	249 J	215 J	189 J	200 J	145
Threshold Effects Concentration	35.8	35.8	**35.8**	35.8	35.8	**35.8**	35.8	35.8	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**
Probable Effects Concentration	128	128	128	128	128	128	128	128	**128**	**128**	**128**	**128**	**128**
Molybdenum	7.49	10.5	5.27	18.5	16.7	25.0	12.2	22.3	5.48	12.2	5.86	13.4	8.1
Threshold Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Probable Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	0.52	0.75	0.36	0.7	0.25	0.7	0.25	0.7	N/D	N/D	N/D	N/D	0.60
Threshold Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Probable Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	46	97	224	90	177	137	163	90	2934	2376	995	1001	3600
Threshold Effects Concentration	121	121	**121**	121	**121**	**121**	**121**	121	**121**	**121**	**121**	**121**	**121**
Probable Effects Concentration	459	459	459	459	459	459	459	459	**459**	**459**	**459**	**459**	**459**

J: Result estimated

N/D: Result not detected

N/A: Not analyzed

Sample results presented as mg/kg

BOLD = TRV is exceeded by the sample concentration TEC and PEC; MacDonald et al., 2000

Note: Results include those collected in the Post-Tailing Spill Sampling Event, November, 1999. (Golder, 2000)

N/A: No comparable benchmark available

N/D: Result less than MDL

Table 4.2-1
Comparison of Sediment Concentrations to TRVs
Hanover and Whitewater Creeks Investigation Unit

Parameter	U02-5002	U02-5004	U02-5005	U02-5008	U02-5009	U02-5100	U02-5101	U02-5102	U02-5103	U02-5104	U02-5105	U02-5108	U02-5109
Cadmium	1.20	4.30	4.70	3.20	3.50	10.9 J	3.86 J	5.15 J	5.63 J	2.57 J	1.26	2.13	2.75 J
Threshold Effects Concentration	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**
Probable Effects Concentration	4.98	4.98	4.98	4.98	4.98	**4.98**	4.98	**4.98**	**4.98**	4.98	4.98	4.98	4.98
Chromium	10.7	4.90	5.70	5.20	6.30	22.2	20.0	22.7	22.8	14.1	11.6	14.0	13.9
Threshold Effects Concentration	43	43	43	43	43	43	43	43	43	43	43	43	43
Probable Effects Concentration	110	110	110	110	110	110	110	110	110	110	110	110	110
Copper	257	820	670	725	817	279	270	251	1833	208	385	294	108
Threshold Effects Concentration	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**
Probable Effects Concentration	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**	149
Lead	61	443	190	207	236	545 J	128 J	186 J	468 J	387 J	144 J	172 J	201 J
Threshold Effects Concentration	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**
Probable Effects Concentration	128	**128**	**128**	**128**	**128**	**128**	**128**	**128**	**128**	**128**	**128**	**128**	**128**
Molybdenum	3.5	9.5	10.0	7.9	6.4	5.30	16.7	5.63	9.97	3.15	8.33	9.37	4.79
Threshold Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Probable Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	0.6	4.20	0.50	1.50	0.80	ND	ND	ND	ND	ND	1.26	0.37	ND
Threshold Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Probable Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	760	1870	1730	1340	1530	4144	1273	1901	2124	857	580	926	850
Threshold Effects Concentration	**121**	**121**	**121**	**121**	**121**	**121**	**121**	**121**	**121**	**121**	**121**	**121**	**121**
Probable Effects Concentration	**459**	**459**	**459**	**459**	**459**	**459**	**459**	**459**	**459**	**459**	**459**	**459**	**459**

J: Result estimated

N/D: Result not detected

N/A: Not analyzed

Sample results presented as mg/kg

BOLD = TRV is exceeded by the sample concentration TEC and PEC; MacDonald et al., 2000

Note: Results include those collected in the Post-Tailing Spill Sampling Event, November, 1999. (Golder, 2000)

N/A: No comparable benchmark available

N/D: Result less than MDL

Table 4.2-1
Comparison of Sediment Concentrations to TRVs
Hanover and Whitewater Creeks Investigation Unit

Parameter	U02-5110	U02-5111	U02-ER011	U03-11150	U03-11254	U03-11255	U03-11256	U03-11260	U03-11261	U03-11262	U03-11284	U03-11288	U03-11366
Cadmium	0.41 J	2.98 J	2.5	0.24 J	N/D	0.19 J	0.34	0.66	0.66	0.49	0.49	0.31	0.27
Threshold Effects Concentration	0.99	**0.99**	**0.99**	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Probable Effects Concentration	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98
Chromium	10.1	10.6	N/A	5.9 J	6.5 J	7.6 J	4.9	23.4	22.4	15.9	11	11.9	8.9
Threshold Effects Concentration	43	43	43	43	43	43	43	43	43	43	43	43	43
Probable Effects Concentration	110	110	110	110	110	110	110	110	110	110	110	110	110
Copper	153	2286	249	183 J	233 J	281 J	118	2360	2000	465	429	784	159
Threshold Effects Concentration	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**
Probable Effects Concentration	**149**	**149**	**149**	**149**	**149**	**149**	149	**149**	**149**	**149**	**149**	**149**	**149**
Lead	147 J	157	71.2	21	21.2	25.1	18.9	42.9	41.4	36	33.9	38.8	34.3
Threshold Effects Concentration	**35.8**	**35.8**	**35.8**	35.8	35.8	35.8	35.8	**35.8**	**35.8**	**35.8**	35.8	**35.8**	35.8
Probable Effects Concentration	**128**	**128**	128	128	128	128	128	128	128	128	128	128	128
Molybdenum	10.49	6.59	3.50 J	13.5	32.4	20.8	11.9	24J	20.8 J	8.0 J	16.9J	18.9	10.3 J
Threshold Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Probable Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	ND	ND	0.25 J	0.30 J	0.46 J	0.81J	0.23 J	0.44 J	0.34 J	---	0.36 J	0.39 J	---
Threshold Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Probable Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	419	536	958	70.1	69.3	66.2	55.9	204	227	158	125	148	103
Threshold Effects Concentration	**121**	**121**	**121**	121	121	121	121	**121**	**121**	**121**	**121**	**121**	121
Probable Effects Concentration	**459**	**459**	**459**	459	459	459	459	459	459	459	459	459	459

J: Result estimated

N/D: Result not detected

N/A: Not analyzed

Sample results presented as mg/kg

BOLD = TRV is exceeded by the sample concentration TEC and PEC; MacDonald et al., 2000

Note: Results include those collected in the Post-Tailing Spill Sampling Event, November, 1999. (Golder, 2000)

N/A: No comparable benchmark available

N/D: Result less than MDL

Table 4.2-1
Comparison of Sediment Concentrations to TRVs
Hanover and Whitewater Creeks Investigation Unit

Parameter	U03-11471	U03-11576	U03-11579	U03-11586	U03-11680	U03-11682	U03-1000	U03-1001	U03-1002	U03-1200	U03-1202	U03-1300	U03-1302
Cadmium	0.62	0.35	0.77 J	1.4	N/D	0.19	1.99	2.37	1.45	3.04	3.55	2.07 J	1.29
Threshold Effects Concentration	0.99	0.99	0.99	**0.99**	0.99	0.99	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**
Probable Effects Concentration	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98
Chromium	12.5	6.4	14.2 J	23.4	18.4	19.4	4.32	4.81	12.0	6.33	15.2	22.6	17.7
Threshold Effects Concentration	43	43	43	43	43	43	43	43	43	43	43	43	43
Probable Effects Concentration	110	110	110	110	110	110	110	110	110	110	110	110	110
Copper	388	157	463 J	941	43	40.5	318	257	249	329	479	469	354
Threshold Effects Concentration	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**
Probable Effects Concentration	**149**	**149**	**149**	**149**	149	149	**149**	**149**	**149**	**149**	**149**	**149**	**149**
Lead	36.1	22.4	41.6 J	90.3	18.9	20.2	1850	2528	522	56 J	58.6 J	223 J	131 J
Threshold Effects Concentration	**35.8**	35.8	**35.8**	**35.8**	35.8	35.8	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**
Probable Effects Concentration	128	128	128	128	128	128	**128**	**128**	**128**	128	128	**128**	**128**
Molybdenum	9.1	6.9 J	10.6 J	11.1 J	2.00	2.00	4.47	N/D	N/D	2.89	4.07	8.20	6.92
Threshold Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Probable Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	N/D	---	---	0.45 J	N/D	N/D	N/D	N/D	N/D	N/D	0.15	N/D	N/D
Threshold Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Probable Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	168	89.1	195 J	378	71	74.5	540	528	313	418	382	1010	658
Threshold Effects Concentration	**121**	121	**121**	**121**	121	121	**121**	**121**	**121**	**121**	**121**	**121**	**121**
Probable Effects Concentration	459	459	459	459	459	459	**459**	**459**	459	459	459	**459**	**459**

J: Result estimated

N/D: Result not detected

N/A: Not analyzed

Sample results presented as mg/kg

BOLD = TRV is exceeded by the sample concentration TEC and PEC; MacDonald et al., 2000

Note: Results include those collected in the Post-Tailing Spill Sampling Event, November, 1999. (Golder, 2000)

N/A: No comparable benchmark available

N/D: Result less than MDL

Table 4.2-1
Comparison of Sediment Concentrations to TRVs
Hanover and Whitewater Creeks Investigation Unit

Parameter	U03-1304	U03-1306	U03-1307	U03-1309	U03-1311	U03-1313	U03-1315	U03-1317	U03-1400	U03-1500 B	U03-1600 B	U03-1700 B	U03-1702 B
Cadmium	N/D	1.46	1.44	1.80	1.68	1.87	2.64	N/D	0.84	3.80	0.73	N/D	N/D
Threshold Effects Concentration	0.99	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	0.99	0.99	**0.99**	0.99	0.99	0.99
Probable Effects Concentration	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98
Chromium	20.9	21.7	18.9	19	15.1	15.7	20.5	17.8	14.9	17.2	6.07	4.47	5.58
Threshold Effects Concentration	43	43	43	43	43	43	43	43	43	43	43	43	43
Probable Effects Concentration	110	110	110	110	110	110	110	110	110	110	110	110	110
Copper	499	587	453	469	374	462	594	287	272	2619	140	99	104
Threshold Effects Concentration	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**
Probable Effects Concentration	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**	149	149	149
Lead	203 J	260 J	214 J	204 J	147 J	173 J	217	183	73.2	25.6	12.6	7.15	10.7
Threshold Effects Concentration	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	35.8	35.8	35.8	35.8
Probable Effects Concentration	**128**	**128**	**128**	**128**	**128**	**128**	**128**	**128**	128	128	128	128	128
Molybdenum	9.11	10.69	11.78	6.90	5.41	12.43	6.59	3.66	N/D	50.7	7.45	4.43	5.88
Threshold Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Probable Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	0.53	0.56	0.56 J	0.41 J	0.26 J	N/D	N/D	N/D	N/D	1.98 J	N/D	N/D	N/D
Threshold Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Probable Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	404	798	650 J	720 J	637 J	800	1016 J	345 J	198 J	451	191	28.1	44.6
Threshold Effects Concentration	**121**	**121**	**121**	**121**	**121**	**121**	**121**	**121**	**121**	**121**	**121**	121	121
Probable Effects Concentration	459	**459**	**459**	**459**	**459**	**459**	**459**	459	459	459	459	459	459

J: Result estimated

N/D: Result not detected

N/A: Not analyzed

Sample results presented as mg/kg

BOLD = TRV is exceeded by the sample concentration TEC and PEC; MacDonald et al., 2000

Note: Results include those collected in the Post-Tailing Spill Sampling Event, November, 1999. (Golder, 2000)

N/A: No comparable benchmark available

N/D: Result less than MDL

Table 4.2-1
Comparison of Sediment Concentrations to TRVs
Hanover and Whitewater Creeks Investigation Unit

Parameter	U03-1800	U03-1900 B	U03-1901 B	U03-1902 B	U03-3003	U03-3004	U03-5006	U03-5007	U03-5009	U03-5010	U03-5016	U03-5017	U03-5023
Cadmium	N/D	1.34	N/D	N/D	0.59	1.35	2.00	0.2	3.5	15.0	2.5	3.0	1.5
Threshold Effects Concentration	0.99	**0.99**	0.99	0.99	0.99	**0.99**	**0.99**	0.99	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**
Probable Effects Concentration	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	**4.98**	4.98	4.98	4.98
Chromium	11	6.07	13.1	6.25	3.62	6.19	6.10	16.7	6.3	6.5	6	9.8	7.6
Threshold Effects Concentration	43	43	43	43	43	43	43	43	43	43	43	43	43
Probable Effects Concentration	110	110	110	110	110	110	110	110	110	110	110	110	110
Copper	220	108.6	113.5	143.3	149	510	581	765	817	1450	623	759	514
Threshold Effects Concentration	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**
Probable Effects Concentration	**149**	149	149	149	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**
Lead	29.6	12.6	24.2	38	316	1836	218	111	236	1030	192	295	234
Threshold Effects Concentration	35.8	35.8	35.8	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**
Probable Effects Concentration	128	128	128	128	**128**	**128**	**128**	128	**128**	**128**	**128**	**128**	**128**
Molybdenum	9.69	4.99	5.25	6.56	3.14	7.10	15.1	31.9	6.40	4.00	8.10	10.7	7.70
Threshold Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Probable Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	0.33	N/D	N/D	N/D	0.13	0.27	0.60	1.30	0.80	N/D	0.80	1.20	1.10
Threshold Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Probable Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	65.7 J	191	81.4	104	137	393	601	198	1530	6000	1230	1380	917
Threshold Effects Concentration	121	**121**	121	121	**121**	**121**	**121**	**121**	**121**	**121**	**121**	**121**	**121**
Probable Effects Concentration	459	459	459	459	459	459	**459**	**459**	**459**	**459**	**459**	**459**	**459**

J: Result estimated

N/D: Result not detected

N/A: Not analyzed

Sample results presented as mg/kg

BOLD = TRV is exceeded by the sample concentration TEC and PEC; MacDonald et al., 2000

Note: Results include those collected in the Post-Tailing Spill Sampling Event, November, 1999. (Golder, 2000)

N/A: No comparable benchmark available

N/D: Result less than MDL

Table 4.2-1
Comparison of Sediment Concentrations to TRVs
Hanover and Whitewater Creeks Investigation Unit

Parameter	U03-5024	U03-5025	U03-5026	U03-5027	U03-5028	U03-5029	U03-5030	U03-5031	U03-5032	U03-5033	U03-5034	U03-5035	U03-5036
Cadmium	3.3	4.10	1.1	1.0	0.8	N/D	0.7	2.0	3.5	0.7	1.6	0.2	N/D
Threshold Effects Concentration	**0.99**	**0.99**	**0.99**	**0.99**	0.99	0.99	0.99	**0.99**	**0.99**	0.99	**0.99**	0.99	0.99
Probable Effects Concentration	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98
Chromium	8.4	2.70	9.2	12	12.9	13.2	14.8	14.7	6.1	9.4	14.4	8.2	5.2
Threshold Effects Concentration	43	43	43	43	43	43	43	43	43	43	43	43	43
Probable Effects Concentration	110	110	110	110	110	110	110	110	110	110	110	110	110
Copper	602	305	465	490	425	474	406	1210	510	711	895	297	211
Threshold Effects Concentration	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**
Probable Effects Concentration	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**	**149**
Lead	263	498	161	201	164	152	171	340	60.4	41.8	25.6	13.7	24.5
Threshold Effects Concentration	**35.8**	**32**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	35.8	35.8	35.8
Probable Effects Concentration	**128**	**149**	**128**	**128**	**128**	**128**	**128**	**128**	128	128	128	128	128
Molybdenum	6.80	0.60	7.80	4.60	3.50	4.70	6.40	16.4	9.50	56.7	27.4	14.7	9.8
Threshold Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Probable Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	0.50	0.10	N/D	0.20	0.20	N/D	0.20	0.90	0.30	2.40	2.90	0.40	0.40
Threshold Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Probable Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	1340	1280	719	706	568	259	430	874	321	153	149	88.2	57.8
Threshold Effects Concentration	**121**	**121**	**121**	**121**	**121**	**121**	**121**	**121**	**121**	**121**	**121**	121	121
Probable Effects Concentration	**459**	**459**	**459**	**459**	**459**	459	459	**459**	459	459	459	459	459

J: Result estimated

N/D: Result not detected

N/A: Not analyzed

Sample results presented as mg/kg

BOLD = TRV is exceeded by the sample concentration TEC and PEC; MacDonald et al., 2000

Note: Results include those collected in the Post-Tailing Spill Sampling Event, November, 1999. (Golder, 2000)

N/A: No comparable benchmark available

N/D: Result less than MDL

Table 4.2-1
Comparison of Sediment Concentrations to TRVs
Hanover and Whitewater Creeks Investigation Unit

Parameter	U03-5037	U03-51050	U03-51052	U03-51053	U03-51055	U03-51056	U03-51058	U03-51060	U03-51062	U03-51063	U03-5200	U03-5201	U03-5500
Cadmium	N/D	0.09 J	0.6	0.26	0.22 J	0.14 J	0.41 J	0.98	0.24	0.75	1.22 J	8.89	1.17
Threshold Effects Concentration	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	**0.99**	**0.99**	**0.99**
Probable Effects Concentration	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	4.98	**4.98**	4.98
Chromium	5.00	9	14.8	15.2	16.2	19	20.5	16	15.3	15.4	9.39	10.4	11.8
Threshold Effects Concentration	43	43	43	43	43	43	43	43	43	43	43	43	43
Probable Effects Concentration	110	110	110	110	110	110	110	110	110	110	110	110	110
Copper	98.5	208	335	210	171	196	263	482	76.4	92.2	759	1338	260
Threshold Effects Concentration	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**
Probable Effects Concentration	149	**149**	**149**	**149**	**149**	**149**	**149**	**149**	149	149	**149**	**149**	**149**
Lead	17.7	23.3	34.3	24.4	21.6	24.7	24.4	47.4	11.1	17.5	312 J	828 J	15.0
Threshold Effects Concentration	35.8	35.8	35.8	35.8	35.8	35.8	35.8	**35.8**	35.8	35.8	**35.8**	**35.8**	35.8
Probable Effects Concentration	128	128	128	128	128	128	128	128	128	128	**128**	**128**	128
Molybdenum	8.7	21.1	11.30	4.40	4.40	2.20 J	3.80 J	11.2	2.80 J	1.50 J	9.96	5.70	N/D
Threshold Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Probable Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	0.40	0.38 J	N/D	N/D	N/D	N/D	N/D	0.10	N/D	N/D	ND	0.33	N/D
Threshold Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Probable Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	54.1	50.8	130	109	71.5	102	140	225	54.4	110	482	4299	69.6 J
Threshold Effects Concentration	121	121	**121**	121	121	121	**121**	**121**	121	121	**121**	**121**	121
Probable Effects Concentration	459	459	459	459	459	459	459	459	459	459	**459**	**459**	459

J: Result estimated

N/D: Result not detected

N/A: Not analyzed

Sample results presented as mg/kg

BOLD = TRV is exceeded by the sample concentration TEC and PEC; MacDonald et al., 2000

Note: Results include those collected in the Post-Tailing Spill Sampling Event, November, 1999. (Golder, 2000)

N/A: No comparable benchmark available

N/D: Result less than MDL

Table 4.2-1
Comparison of Sediment Concentrations to TRVs
Hanover and Whitewater Creeks Investigation Unit

Parameter	U03-5501	U03-5502	U03-5503	U03-ER001	U03-ER002	U03-ER004	U03-ER005	U03-ER006
Cadmium	6.43	10.13	8.10	2.9	2.4	1.5	0.49 J	0.26 J
Threshold Effects Concentration	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	**0.99**	0.99	0.99
Probable Effects Concentration	**4.98**	**4.98**	**4.98**	4.98	4.98	4.98	4.98	4.98
Chromium	11.0	24.5	41.4	N/A	N/A	N/A	N/A	N/A
Threshold Effects Concentration	43	43	43	43	43	43	43	43
Probable Effects Concentration	110	110	110	110	110	110	110	110
Copper	1641	3366	2859	622	307	387	111	358
Threshold Effects Concentration	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**
Probable Effects Concentration	**149**	**149**	**149**	**149**	**149**	**149**	149	**149**
Lead	70.9	80.9	98.4	682	134	99	5.9	39.8
Threshold Effects Concentration	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	**35.8**	35.8	**35.8**
Probable Effects Concentration	128	128	128	**128**	**128**	128	128	128
Molybdenum	24.7	45.6	81.1	7.10	2.5 J	5.30	1.00 J	1.60 J
Threshold Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Probable Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	1.61	2.15	4.75	0.40 J	0.27 J	0.33 J	0.24 J	0.26 J
Threshold Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Probable Effects Concentration	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	100 J	192 J	198 J	335	979	707	24.2	43.2
Threshold Effects Concentration	121	**121**	**121**	**121**	**121**	**121**	121	121
Probable Effects Concentration	459	459	459	459	**459**	**459**	459	459

J: Result estimated

N/D: Result not detected

N/A: Not analyzed

Sample results presented as mg/kg

BOLD = TRV is exceeded by the sample concentration TEC and PEC; MacDonald et al., 2000

Note: Results include those collected in the Post-Tailing Spill Sampling Event, November, 1999. (Golder, 2000)

N/A: No comparable benchmark available

N/D: Result less than MDL

FIGURES

APPENDIX A

Hanover and Whitewater Creeks Investigation Unit Data

Appendix Table 1 (A-1)
Summer Rainfall Pool Sample Results-Total Fraction
Hanover and Whitewater Creeks Investigation Unit

Physical Reach	Sample No	Source	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Hardness	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel	pH	Selenium	Silver	TDS	Thallium	TSS	Vanadium	Zinc
1	U02-9100	Phase 1 RI (2000)	0.013 U	0.0248 U	0.0015	0.0523	0.0002 U	0.063	0.0128	N/A	0.00345 U	0.0036 U	0.0138	1740	0.013 U	0.0014 J	N/A	2.21 J	0.00005 U	0.0246	0.0158 U	6.45	0.0065 UJ	0.00175 U	351	0.00055 U	0.05 U	0.00415 U	1.9 J
	HC-51.6	Golder (2007)	0.299	0.0055	0.0045 U	0.0774	N/A	0.0084 U	0.0048	N/A	0.0013	0.00075	0.0397 J	1450	0.36	0.0026	N/A	0.3	0.0001 U	0.0357	0.0024 U	8.1	0.0023	0.00002 U	2172	0.00005 U	8	0.0017	1.55 J
2	WWC-38.1	Golder (2007)	0.537	0.0055 U	0.0045 U	0.0578	N/A	0.0084 U	0.0098	N/A	0.0017	0.0094	0.279 J	1600	0.0184	0.0014	N/A	1.23	0.0001 U	0.0101	0.0153	7.9	0.0022	0.00002 U	2238	0.00005 U	5	0.0007 U	1.81
	U03-9200	Phase 1 RI (2000)	0.013 U	0.0248 U	0.00075 U	0.0383	0.0002 U	0.0404	0.0067	N/A	0.00345 U	0.0036 U	0.0168	1314	0.0138 U	0.0016 J	N/A	0.679 J	0.00005 U	0.00665 U	0.0158 U	6.05	0.0065 UJ	0.00175 U	2070	0.00055 U	0.2	0.00415 U	0.443 J
3	U03-9300	Phase 1 RI (2000)	0.369	0.0248 U	0.0017	0.0248	0.0002 U	0.0363	0.00031 J	N/A	0.00345 U	0.0036 U	0.0523	76	0.323	0.0129	N/A	0.0417 J	0.00005 U	0.00665 U	0.0158 U	5.57	0.00065 U	0.00175 U	158	0.00055 U	3	0.00415 U	0.0391 J
	U03-9301	Phase 1 RI (2000)	9.46	0.0248 U	0.0042	0.0698	0.00026 U	0.0458	0.0001 J	N/A	0.00345 U	0.0036 U	0.0898	79	6.63	0.0162	N/A	0.31 J	0.00005 U	0.00665 U	0.0158 U	6.02	0.00065 UJ	0.00175 U	225	0.00055 U	17	0.0144	0.0264 J
	U03-9302	Phase 1 RI (2000)	6.07	0.0248 U	0.00075 U	0.0355	0.0023	0.0381	0.0132	N/A	0.00345 U	0.0903	1.1	741	0.264	0.0156	N/A	3.55 J	0.00005 U	0.00665 U	0.0158 U	5.31	0.0065 UJ	0.00175 U	1180	0.00055 U	31	0.0105	3.08 J
	BC-1	Golder (2007)	0.018	0.0055 U	0.0045 U	0.0589	N/A	0.0204	0.00082	N/A	0.00084	0.0002 U	0.0325 J	169	0.0766	0.0024	N/A	0.0574	0.0001 U	0.0073	0.0019 U	7.7	0.0011	0.00003	282	0.00005 U	5	0.0019	0.109 J
	B-RANCH	Golder (2007)	28.9	0.0144 UJ	0.0051 U	0.0534	N/A	0.144	0.0343	N/A	0.0004 U	0.366	2.43	1770	0.0245	0.0082	N/A	16.2	0.0001 U	0.0049	0.219	4.2	0.0041	0.00011	3002	0.00005 U	5	0.00048	7.88
	GRUNERUD-1	Golder (2007)	14.2	0.0145 UJ	0.0051 U	0.0727	N/A	0.142	0.0278	N/A	0.0004 U	0.176	1.35	1820	0.0206	0.0056	N/A	10.4	0.0001 U	0.0051	0.138	4.6	0.003	0.00008	2858	0.00005 U	14	0.00059	5.54
	WWC-28.6	Golder (2007)	39	0.0055 U	0.0045 U	0.31	N/A	0.0084 U	0.011	N/A	0.0174	0.048	0.65 J	1460	30.8	0.0755	N/A	3.12	0.00018	0.0065	0.0401	7.2	0.0025	0.00031	1952	0.00022	1084	0.0437	2.04 J
	WWC-29.7	Golder (2007)	0.079	0.0055 U	0.0045 U	0.0588	N/A	0.0084 U	0.0016	N/A	0.0007 U	0.0013	0.0326 J	515	0.0253	0.00082	N/A	0.312	0.0001 U	0.0089	0.0038 U	7.5	0.0017	0.00002 U	763	0.00005 U	5	0.00072	0.218 J
5	U03-9500	Phase 1 RI (2000)	0.013 U	0.0248 U	0.00075 U	0.0445	0.00028 U	0.046	0.0026	N/A	0.00345 U	0.0036 U	0.0987	109	0.0619	0.0004 U	N/A	0.207 J	0.00005 U	0.00665 U	0.0158 U	6.03	0.00065 U	0.00175 U	245	0.00055 U	0.05 U	0.00415 U	0.0166 J
6	U03-9600	Phase 1 RI (2000)	0.365	0.0248 U	0.00075 U	0.0557	0.00024 U	0.0551	0.0161 J	N/A	0.00345 U	0.0282	0.566	432	0.0103 U	0.0004 U	N/A	2.08 J	0.00005 U	0.00665 U	0.0158	4.64	0.00065 UJ	0.00175 U	748	0.00055 U	4	0.00415 U	0.968 J
9	U03-9900	Phase 1 RI (2000)	31	0.0248 U	0.0032 J	0.155	0.0014	0.0298	0.0038	N/A	0.0199	0.0344	1.51	225	28.1	0.141	N/A	1.42 J	0.00005 U	0.0137	0.0158 U	5.85	0.0065 U	0.00175 U	347	0.00055 U	488	0.0384	0.83 J
	LWWC-1	Golder (2007)	1.5	0.0129 U	0.0051 U	0.034	N/A	0.039	0.0052	N/A	0.0004 U	0.0577	0.557	347	0.014 U	0.00013 U	N/A	2.34	0.0001 U	0.0032	0.0523	5	0.00091	0.00002 U	589	0.00005 U	6	0.00068	0.872
	WWC-H180	Golder (2007)	1.88	0.0128 U	0.0051 U	0.0787	N/A	0.059	0.0107	N/A	0.00043	0.0871	0.537	725	0.014 U	0.00013 U	N/A	6.1	0.0001 U	0.0052	0.159	5.9	0.0019	0.00002 U	1190	0.00005 U	8	0.00084	1.63
Bayard Canyon	BAYARD CANYON D/S	Golder (2008)	0.013 U	0.002 U	0.0143 J	0.0775	N/A	0.028 J	0.0026 J	44	0.0013 U	0.0013 U	0.0333	155	0.242	0.0037 J	10.9	0.0147	0.0001 U	0.0137	0.0011 U	6.75	0.00066 J	0.00005 U	305	0.00005 U	4.2 U	0.0022 J	0.281
	BAYARD CANYON MID	Golder (2008)	0.016 J	0.002 U	0.0098 J	0.0666	N/A	0.0289 J	0.003 J	40.9	0.0013 U	0.0013 U	0.031	143	0.0109 J	0.0047 J	9.83	0.0198	0.0001 U	0.0147	0.0011 U	6.9	0.00045 J	0.00005 U	286	0.00005 U	4.2 U	0.0022 J	0.328
	BAYARD CANYON U/S	Golder (2008)	0.014 J	0.002 U	0.0127 J	0.054	N/A	0.0186 J	0.0048 J	51.9	0.0013 U	0.0013 U	0.0384	179	0.0094 J	0.0049 J	12.1	0.0036 J	0.0001 U	0.016	0.0011 U	6.94	0.00055 J	0.00007 J J	352	0.00005 U	4.2 U	0.0025 J	0.418
	BAYARD/LB CON	Golder (2008)	0.013 U	0.002 U	0.0126 J	0.0762	N/A	0.0202 J	0.00044 J	48	0.0013 U	0.0013 U	0.0061 J	172	0.0197 J	0.0025 J	12.8	0.0618	0.0001 U	0.0133	0.0011 U	6.76	0.00036 J	0.00005 U	352	0.00005 U	4.2 U	0.0018 J	0.145
	U03-9001	Phase 1 RI (2000)	0.42	0.0248 U	0.0015	0.0715	0.0002 U	0.0313	0.0052	N/A	0.00345 U	0.0036 U	0.0554	168	0.257	0.0299	N/A	0.0294 J	0.00005 U	0.00665 U	0.0158 U	5.8	0.00065 UJ	0.00175 U	313	0.00055 U	0.05 U	0.00415 U	0.333 J
	U03-9002	Phase 1 RI (2000)	0.034 U	0.0248 U	0.00075 U	0.0315	0.0002 U	0.0298	0.00005 UJ	N/A	0.00345 U	0.0036 U	0.0244	36	0.0525 U	0.0004 U	N/A	0.0231 J	0.00005 U	0.00665 U	0.0158 U	5.2	0.00065 U	0.00175 U	110	0.00055 U	0.05 U	0.00415 U	0.0018 UJ
	BFT-1	Golder (2007)	0.148	0.0055 U	0.0045 U	0.0272	N/A	0.0084	0.00007 U	N/A	0.0007 U	0.0002 U	0.02 J	23	0.0976	0.00027	N/A	0.0039	0.0001 U	0.0018	0.0019 U	6.3	0.00064	0.00002 U	9	0.00005 U	5	0.0007 U	0.0035 U
Lucky Bill Canyon	LUCKY BILL AT NO.5	Golder (2008)	0.013 U	0.002 U	0.0097 J	0.0567	N/A	0.0199 J	0.0002 J	43.5	0.0013 U	0.0013 U	0.0053 J	158	0.0469 J	0.00041 J	11.9	0.0983	0.0001 U	0.0124	0.0011 U	6.84	0.00034 J	0.00005 U	330	0.00005 U	4.2 U	0.0013 J	0.0902
	LUCKY BILL MOUTH	Golder (2008)	0.013 U	0.002 U	0.012 J	0.0671	N/A	0.0147 J	0.00009 J	49.5	0.0013 U	0.0013 U	0.0041 J	180	0.0744	0.00031 J	13.8	0.0596	0.0001 U	0.0137	0.0011 U	6.8	0.00045 J	0.00005 U	365	0.00005 U	4.2 U	0.0014 J	0.0172
	LUCKY BILL U/S NO.5	Golder (2008)	0.0197 J	0.002 U	0.0088 U	0.0578	N/A	0.0203 J	0.00005 U	33.4	0.0013 U	0.0013 U	0.0048 J	126	0.174	0.00011 J	10.3	0.116	0.0001 U	0.0109	0.0011 U	6.42	0.00043 J	0.00005 U	283	0.00005 U	4.2 U	0.0014 J	0.004 J
	U03-9000	Phase 1 RI (2000)	0.0229 U	0.0248 U	0.00075 U	0.0383	0.0002 U	0.0298	0.00005 UJ	N/A	0.00345 U	0.0036 U	0.01	86	0.0363 U	0.0004 U	N/A	0.0412 J	0.00005 U	0.00665 U	0.0158 U	5.47	0.00065 UJ	0.00175 U	225	0.00055 U	0.05	0.00415 U	0.0018 UJ
Lower Whitewater	LWWCR.RANCHERSPOND	Golder (2008)	0.159	0.0034 U	0.0046 U	0.0315	N/A	0.0286	0.0001 J	N/A	0.0004 U	0.0012 J	0.0391	228	0.209	0.00043 J	N/A	0.188	0.0001 U	0.0093	0.003 J	7.23	0.0011 J	0.00002 U	404	0.00002 U	9	0.0005 U	0.0023 J

U: Result not detected
J: Result Estimated
R: Result Rejected

Appendix Table 2 (A-2)
Summer Rainfall Pool Results-Dissolved (0.45 µm) Fraction
Hanover and Whitewater Creeks Investigation Unit

Physical Reach	Sample No	Source	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
1	U02-9100	Phase 1 RI (2000)	0.0164 U	0.0248 U	0.00075 U	0.0576	0.0002 U	0.057	0.0132	0.00345 U	0.00345 U	0.0142 J	0.0103 U	0.00065 UJ	2.45	0.00005 U	0.0332	0.0158 U	R	0.00175 UJ	0.00055 U	0.00415 U	2.16
	HC-51.6	Golder (2007)	0.0069 U	0.0056 U	0.0045 U	0.0787 J	N/A	0.0084 U	0.0043	0.0007 U	0.0007	0.0122	0.0015	0.00015	0.222	0.0001 U	0.0386	0.0019 U	0.0024	0.00004 U	0.00002 UJ	0.00078	1.38
2	U03-9200	Phase 1 RI (2000)	0.0175 U	0.0248 U	0.00075 U	0.0358	0.0002 U	0.0138 U	0.007	0.00345 U	0.00345 U	0.0104	0.0134 U	0.00055 UJ	0.73	0.00005 U	0.00665 U	0.0158 U	R	0.00175 UJ	0.00055 U	0.0066 U	0.484
	WWC-38.1	Golder (2007)	0.156	0.0055 U	0.0045 U	0.0585 J	N/A	0.0084 U	0.0095	0.0007 U	0.0007	0.209	0.0015	0.00061	1.2	0.0001 U	0.0098	0.0144	0.0021	0.00004 UJ	0.00004 U	0.0007 U	1.72 J
3	U03-9300	Phase 1 RI (2000)	0.0266 U	0.0248 U	0.0075 U	0.0201	0.0002 U	0.0138 U	0.00022 J	0.00345 U	0.00345 U	0.047	0.0342 U	0.00135 U	0.0311	0.00005 U	0.00665 U	0.0158 U	R	0.00175 UJ	0.00055 U	0.00475 U	0.029
	U03-9301	Phase 1 RI (2000)	0.013 U	0.0248 U	0.0032	0.0358	0.0002 U	0.0309	0.00005 UJ	0.00345 U	0.00345 U	0.0266	0.0138 U	0.0004 U	0.139	0.00005 U	0.00665 U	0.0158 U	R	0.00175 UJ	0.00055 U	0.0059 U	0.0018 U
	U03-9302	Phase 1 RI (2000)	0.0261	0.0495 U	0.015	0.0331	0.00045 U	0.036	0.0134	0.00345 U	0.00345 U	0.844	0.0103 U	0.0046 U	3.92	0.00005 U	0.00665 U	0.0158 U	R	0.00175 UJ	0.00055 U	0.0073 U	3.42
	BC-1	Golder (2007)	0.01	0.0055 U	0.0045 U	0.058 J	N/A	0.0202 U	0.00053	0.0007 U	0.0007	0.0303	0.0448	0.0014	0.0567	0.0001 U	0.0075	0.0019 U	0.0011	0.00004 UJ	0.00002 U	0.0019	0.103 U
	B-RANCH	Golder (2007)	28.8	0.0175 UJ	0.0051 U	0.0496 J	N/A	0.15	0.0342	0.00042	0.00042	2.34	0.0154	0.008	15.9	0.0001 U	0.0052	0.204	0.0062	0.00009 J	0.00004 U	0.00068	7.89 U
	GRUNERUD-1	Golder (2007)	14	0.016 UJ	0.0051 U	0.0755 J	N/A	0.137	0.0272	0.0004 U	0.0004	1.22	0.0169	0.0057	10.2	0.0001 U	0.0057	0.143	0.0055	0.00006 J	0.00004 U	0.0004 U	5.84
	WWC-28.6	Golder (2007)	0.153	0.0055 U	0.0045 U	0.0564 J	N/A	0.0084 U	0.009	0.0007 U	0.0007	0.144	0.0052	0.00044	2.13	0.0001 U	0.0034	0.0265	0.0014	0.00004 UJ	0.00002 U	0.0007 U	1.67
	WWC-29.7	Golder (2007)	0.0321	0.0055 U	0.0045 U	0.0572 J	N/A	0.0084 U	0.0013	0.0007 U	0.0007	0.305	0.007	0.0003	0.309	0.0001 U	0.0075	0.0044 U	0.0024	0.00004 UJ	0.00002 U	0.00072	0.21
5	U03-9500	Phase 1 RI (2000)	0.013 U	0.0248 U	0.0075 U	0.0428	0.0002 U	0.0138 U	0.0024	0.00345 U	0.00345 U	0.093	0.0144 U	0.0004 U	0.217	0.00005 U	0.00665 U	0.0158 U	R	0.00175 UJ	0.00055 U	0.00415 U	0.0166
6	U03-9600	Phase 1 RI (2000)	0.37	0.0248 U	0.002	0.0611	0.0002 U	0.0331	0.037 J	0.00345 U	0.00345 U	0.599	0.0113 U	0.0004 U	2.16	0.00005 U	0.00665 U	0.073	R	0.00175 UJ	0.00055 U	0.00415 U	1.06
9	U03-9900	Phase 1 RI (2000)	0.0198 U	0.0248 U	0.00075 U	0.0225	0.0002 U	0.0138 U	0.0012	0.0077	0.0077	0.0494	0.0141 U	0.0004 U	0.668	0.00005 U	0.00665 U	0.0158 U	R	0.00175 UJ	0.00055 U	0.0045 U	0.0371
	LWWC-1	Golder (2007)	0.726	0.0092 U	0.0051 U	0.0357 J	N/A	0.0388	0.0052	0.0004 U	0.0004	0.554	0.014 U	0.0001	2.31	0.0001 U	0.0031	0.0547	0.0015	0.00002 UJ	0.00004	0.0004 U	0.901
	WWC-H180	Golder (2007)	0.476	0.0117 U	0.0051 U	0.0729 J	N/A	0.0569	0.0106	0.0004 U	0.0004	0.481	0.014 U	0.00013	6.12	0.0001 U	0.0041	0.15	0.0024	0.00002 UJ	0.00005	0.00094	1.6
Bayard Canyon	BAYARD CANYON D/S	Golder (2008)	0.013 U	0.002 U	0.0144 J	0.076	N/A	0.0265 J	0.0027 J	0.0013 U	0.0013 U	0.0299	0.0076 U	0.002 J	0.0112	0.0001 U	0.0139	0.0015 J	0.00072 J	0.00005 U	0.00005 U	0.0022 J	0.278
	BAYARD CANYON MID	Golder (2008)	0.013 U	0.002 U	0.0141 J	0.0675	N/A	0.0313 J	0.0033 J	0.0013 U	0.0013 U	0.028	0.0076 U	0.0032 J	0.0201	0.0001 U	0.0138	0.0011 U	0.00067 J	0.00005 U	0.00005 U	0.0019 J	0.354
	BAYARD CANYON U/S	Golder (2008)	0.013 U	0.002 U	0.0164 J	0.0572	N/A	0.0167 J	0.0044 J	0.0013 U	0.0013 U	0.0305	0.0076 U	0.0037 J	0.0032 J	0.0001 U	0.0137	0.0011 U	0.00071 J	0.00005 U	0.00005 U	0.0024 J	0.374
	BAYARD/LB CON	Golder (2008)	0.013 U	0.002 U	0.0134 J	0.0759	N/A	0.0165 J	0.00042 J	0.0013 U	0.0013 U	0.0044 J	0.0076 U	0.0017 J	0.0595	0.0001 U	0.0127	0.0011 U	0.00058 J	0.00005 U	0.00005 U	0.0016 J	0.144
	BFT-1	Golder (2007)	0.0627	0.0055 U	0.0045 J	0.0268 J	N/A	0.0084 U	0.0001 UJ	0.0007 U	0.0007	0.021	0.0465	0.00017	0.0041	0.0001 U	0.0014	0.0019 U	0.00057	0.00004 UJ	0.00002 U	0.0007 U	0.0019 U
	U03-9001	Phase 1 RI (2000)	0.013 U	0.0248 U	0.00075 U	0.0724	0.0002 U	0.0293	0.0044	0.00345 U	0.00345 U	0.0536	0.013 U	0.0105	0.0277	0.00005 U	0.00665 U	0.0158 U	R	0.00175 UJ	0.00055 U	0.00415 U	0.358
	U03-9002	Phase 1 RI (2000)	0.0186 U	0.0248 U	0.00075 U	0.0297	0.0002 U	0.0138 U	0.00005 UJ	0.00345 U	0.00345 U	0.0228	0.0448 U	0.0004 U	0.02	0.00005 U	0.00665 U	0.0158 U	R	0.00175 UJ	0.00055 U	0.0057 U	0.0018 U
Lucky Bill Canyon	LUCKY BILL AT NO.5	Golder (2008)	0.013 U	0.002 U	0.0131 J	0.057	N/A	0.0175 J	0.00019 J	0.0013 U	0.0013 U	0.0034 J	0.0076 U	0.00007 U	0.0917	0.0001 U	0.0109	0.0011 U	0.00061 J	0.00005 U	0.00005 U	0.0013 J	0.0892
	LUCKY BILL MOUTH	Golder (2008)	0.013 U	0.002 U	0.0148 J	0.0667	N/A	0.0148 J	0.00007 J	0.0013 U	0.0013 U	0.002 J	0.0145 J	0.00007 U	0.0547	0.0001 U	0.013	0.0011 U	0.00063 J	0.00005 U	0.00005 U	0.0014 J	0.0152
	LUCKY BILL U/S NO.5	Golder (2008)	0.013 U	0.002 U	0.0119 J	0.0561	N/A	0.0166 J	0.00005 U	0.0013 U	0.0013 U	0.0021 J	0.043 J	0.00007 U	0.105	0.0001 U	0.0109	0.0011 U	0.00063 J	0.00005 U	0.00005 U	0.0014 J	0.003 U
	U03-9000	Phase 1 RI (2000)	0.013 U	0.0248 U	0.00075 U	0.0375	0.0002 U	0.0138 U	0.00005 UJ	0.00345 U	0.00345 U	0.009	0.0356 U	0.0004 U	0.0411	0.00005 U	0.00665 U	0.0158 U	R	0.00175 UJ	0.00055 U	0.0043 U	0.0018 U
Lower Whitewater	LWWCR.RANCHERSPOND	Golder (2008)	0.011 U	0.0034 U	0.0069 J	0.0276	N/A	0.0265 J	0.00007	0.0004 U	0.0004 U	0.0244	0.0162 J	0.00003 U	0.0373	0.0001 U	0.0079 J	0.0048 U	0.0013	0.00002 U	0.00003 J	0.0005 U	0.0007 U

U: Result not detected
J: Result Estimated
R: Result Rejected

Appendix Table 3 (A-3)
All Sediment Data
Hanover and Whitewater Creeks Investigation Unit

Parameter	GA12	GA31	GA50	U02-5001	U02-5002	U02-5003	U02-5004	U02-5005	U02-5008	U02-5009
Aluminum (mg/kg)	5,990	5,720	16,800	5920	11,900	5140	4620	5890	4300	6740
Antimony (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic (mg/kg)	1.4	2.10	2.8	2.89	7.6	37.4	4.27	3.5	6.09	7.1
Barium (mg/kg)	63.2	51.3	139	46.3	153	133	45.1	57.5	85	44.8
Beryllium (mg/kg)	N/A	N/A	N/A	0.05 U	0.4	0.05 U	0.05 U	0.2	0.05 U	0.3
Boron (mg/kg)	9.8	5.00	6.2	4.3	4.4	2.3	2.1	4.9	3.5	3.3
Cadmium (mg/kg)	0.21 U	0.50	0.75	7.6	1.2	0.8	4.3	4.7	3.2	3.5
Calcium (mg/kg)	N/A	N/A	N/A	N/A	7920	15,300	N/A	N/A	N/A	N/A
Chromium (mg/kg)	8.8	19.6	15.6	8.8	10.7	8.9	4.9	5.7	5.2	6.3
Cobalt (mg/kg)	7.0	11.7	8.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper (mg/kg)	98.5	199	435	926	257	421	820	670	725	817
Iron (mg/kg)	28100	59,500	22,200	71.500	42.900	61.700	98.000	50.200	52.200	44.000
Lead (mg/kg)	10.6	23.0	50.7	145	61	1470	443	190	207	236
Manganese (mg/kg)	424	468	769	2060	2420	1690	1540	2720	2040	1450
Mercury (mg/kg)	0.049 U	0.05 U	0.045 U	0.1 U	0.05 U	0.2	0.1 U	0.1 U	0.1 U	35 U
Molybdenum (mg/kg)	7.49	10.50	5.27	8.1	3.5	2.2	9.5	10	7.9	6.4
Nickel (mg/kg)	6.5	8.00	14.6	9.46	8.60	6.00	8.49	7.75	7.97	7.2
paste pH (SU)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium (mg/kg)	0.52	0.75	0.36	0.6	0.6	1.6	4.2	0.5	1.5	0.8
Silver (mg/kg)	0.31 U	0.6 U	0.28 U	0.8	0.1 U	2.9	1	0.1 U	0.1 U	0.1 U
Thallium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TOC (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium (mg/kg)	N/A	N/A	N/A	52.5	32.7	25.0	18.6	28.6	22.6	23.3
Zinc (mg/kg)	46	97.0	224	3600	760	548	1870	1730	1340	1530

Parameter	U03-5006	U03-5007	U03-5009	U03-5010	U03-5011	U03-5012	U03-5013	U03-5014	U03-5016	U03-5017
Aluminum (mg/kg)	11,500	7930	6740	15,800	6500	21,600	16,100	23,400	6050	6330
Antimony (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic (mg/kg)	2.6	3.6	7.13	6	3.08	18.5	22.8	37	5.62	8.42
Barium (mg/kg)	131	83.7	44.8	122	N/A	N/A	N/A	N/A	39.1	59
Beryllium (mg/kg)	0.5	0.05 U	0.3	0.8	N/A	N/A	N/A	N/A	0.2	0.2
Boron (mg/kg)	3.2	4.1	3.3	3.1	N/A	N/A	N/A	N/A	0.7 U	3
Cadmium (mg/kg)	2	0.2	3.5	15	0.1 U	1 U	2.7	53.3	2.5	3
Calcium (mg/kg)	6420	3320	10,800	10,500	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (mg/kg)	6.1	16.7	6.3	6.5	14.4	90.4	59.2	54.3	6	9.8
Cobalt (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper (mg/kg)	581	765	817	1450	305	5590	3270	93.300	623	759
Iron (mg/kg)	36.000	60.300	44.000	27.500	45.300	159.000	122.000	91.800	42.500	59.900
Lead (mg/kg)	218	111	236	1030	169	2140	1180	1940	192	295
Manganese (mg/kg)	2140	347	1450	2910	895	645	511	1010	1090	1530
Mercury (mg/kg)	0.05 U	0.05 U	0.1 U	0.05 U	N/A	N/A	N/A	N/A	0.1 U	0.1 U
Molybdenum (mg/kg)	15.1	31.9	6.4	4	6.7	24.7	17.3	28.1	8.1	10.7
Nickel (mg/kg)	6.8	5.6	7.2	8.7	3.65	25	10.5	128	5.59	8.57
paste pH (SU)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium (mg/kg)	0.6	1.3	0.8	0.5 U	0.2	1.5	2	4.8	0.8	1.2
Silver (mg/kg)	0.6	0.1 U	0.1 U	1.5	N/A	N/A	N/A	N/A	0.1 U	0.1 U
Thallium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TOC (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium (mg/kg)	25.7	25.6	23.3	26.3	N/A	N/A	N/A	N/A	20	24.4
Zinc (mg/kg)	601	198	1530	6000	283	409	535	1680	1230	1380

Parameter	U03-5023	U03-5024	U03-5025	U03-5026	U03-5027	U03-5028	U03-5029	U03-5030	U03-5031
Aluminum (mg/kg)	6130	6750	4200	9290	7380	7910	9720	9220	16,600
Antimony (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic (mg/kg)	8.38	7.89	3.1	4.88	3.83	3.26	3.62	3.19	6.32
Barium (mg/kg)	61	56.4	57.8	58.1	67.6	63.3	105	71.9	117
Beryllium (mg/kg)	0.1	0.4	0.3	0.4	0.2	0.4	0.3	0.3	0.7
Boron (mg/kg)	2.2	3.2	0.07 U	3.8	3.4	4.8	3.9	3.2	6.3
Cadmium (mg/kg)	1.5	3.3	4.1	1.1	1	0.8	0.2 U	0.7	2
Calcium (mg/kg)	N/A	N/A	1910	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (mg/kg)	7.6	8.4	2.7	9.2	12	12.9	13.2	14.8	14.7
Cobalt (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper (mg/kg)	514	602	305	465	490	425	474	406	1210
Iron (mg/kg)	50.300	41.100	10.600	42.000	57.800	46.200	63.500	57.300	46.900
Lead (mg/kg)	234	263	498	161	201	164	152	171	340
Manganese (mg/kg)	1100	1660	532	1030	971	929	567	815	1030
Mercury (mg/kg)	0.1 U	0.1 U	0.05 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Molybdenum (mg/kg)	7.7	6.8	0.6	7.8	4.6	3.5	4.7	6.4	16.4
Nickel (mg/kg)	4.62	7.97	4	7.75	7.08	10.5	7.23	5.96	11.6
paste pH (SU)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium (mg/kg)	1.1	0.5	0.1	0.5 U	0.2	0.2	0.5 U	0.2	0.9
Silver (mg/kg)	0.1 U	0.1 U	0.5	0.1 U	0.6	0.4	0.8	0.1 U	0.7
Thallium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TOC (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium (mg/kg)	22.2	25.4	24.6	28.7	28.2	29.7	33.6	37	30.7
Zinc (mg/kg)	917	1340	1280	719	706	568	259	430	874

N/A: Not Available
U: Result not detected
J: Result estimated

Appendix Table 3 (A-3)
All Sediment Data
Hanover and Whitewater Creeks Investigation Unit

Parameter	U03-5032	U03-5033	U03-5034	U03-5035	U03-5036	U03-5037	U03-5039	U03-5040	U03-5041	U03-5042	U03-7300	U03-7301	U03-7302	U03-7303
Aluminum (mg/kg)	9160	6350	10,200	6100	4600	7830	9510	12,500	11,900	10,800	N/A	N/A	N/A	N/A
Antimony (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic (mg/kg)	2.08	2.32	2.73	2.02	1.64	2.3	6.16	4.35	2.4	2.97	1.14	3.19	3.59	13.83
Barium (mg/kg)	93.9	98.7	62.5	70.9	53.3	71.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Beryllium (mg/kg)	0.5	0.3	0.4	0.1	0.3	0.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Boron (mg/kg)	4.4	3.8	6.6	4.1	3.3	4.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium (mg/kg)	3.5	0.7	1.6	0.2	0.2 U	0.1 U	0.1	1.5	0.1	1	1.44	3	2.11	1.8
Calcium (mg/kg)	N/A	N/A	N/A	N/A	N/A	1240	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (mg/kg)	6.1	9.4	14.4	8.2	5.2	5	21.6	47.2	22.5	43.7	11.6	15.3	15.9	11.1
Cobalt (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper (mg/kg)	510	711	895	297	211	98.5	666	2330	595	565	357	925	508	466
Iron (mg/kg)	17,300	57,600	80,500	32,100	19,300	16,600	43,900	86,600	64,800	102,000	N/A	N/A	N/A	N/A
Lead (mg/kg)	60	42	26	14	25	17.7	172	178	85.2	120	90.6	114	145	137
Manganese (mg/kg)	530	348	591	348	314	222	530	436	573	350	N/A	N/A	N/A	N/A
Mercury (mg/kg)	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.5 U	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Molybdenum (mg/kg)	9.5	56.7	27.4	14.7	9.8	8.7	11.3	0.3	2.1	3	4.47	5.06	4.73	3.35
Nickel (mg/kg)	26.7	11.2	16.2	5.66	6.18	1.05 U	5.36	13.8	5.29	5.29	9.80	15.7	9.25	9.25
paste pH (SU)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium (mg/kg)	0.3	2.4	2.9	0.4	0.4	0.4	0.5	0.2	0.05	0.5	0.13	0.13	0.13	0.20
Silver (mg/kg)	0.2	0.7	0.9	0.1 U	0.1 U	0.1 U	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Thallium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TOC (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium (mg/kg)	23	20.5	21.8	25	21.3	23.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc (mg/kg)	321	153	149	88	58	54.1	332	324	264	271	426	657	483	440

Parameter	U03-7304	U03-7305	U02-5100	U02-5101	U02-5102	U02-5103	U02-5104	U02-5105	U02-5108	U02-5109	U02-5110	U02-5111	U02-1100	U02-1102	U02-1103
Aluminum (mg/kg)	N/A	N/A	8204	5028	15,587	18,758	16,046	9955	12,765	16,370	9962	5267	4940	6115	3743
Antimony (mg/kg)	N/A	N/A	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	10.6 J	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	5.71 UJ	6.61 UJ	6.24 UJ	4.95 UJ
Arsenic (mg/kg)	1.42	3.20	11.1 J	5.08 J	9.19 J	10.6 J	3.37	7.68	2.67	1.43 J	0.803 J	3.1 J	3.89 J	4.02 J	5.9 J
Barium (mg/kg)	N/A	N/A	104	122	166	122	203	136	130	136	97.6	188	82.2	55.6	102
Beryllium (mg/kg)	N/A	N/A	0.44 U	0.11 U	1.02	1.91	0.338 U	0.266 U	0.306 U	0.235 U	0.116 U	0.172 U	0.202 U	0.269 U	0.145 U
Boron (mg/kg)	N/A	N/A	8.22	16.4	5.08 U	12.4	9.57	12.5	10.2	6.92	4.12 U	4.59 U	3.68 U	6.61 U	6.29 U
Cadmium (mg/kg)	1.13	2.88	10.9 J	3.86 J	5.15 J	5.63 J	2.57	1.26	2.13	2.75 J	0.41 UJ	2.98 J	7.55 J	6.05 J	1.59 J
Calcium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (mg/kg)	7.21	11.9	22.2	20	22.7	22.8	14.1	11.6	14	13.9	10.1	10.6	11	14.3	6.36 U
Cobalt (mg/kg)	N/A	N/A	13.4	3.22	12.4	18	14.6	13.1	13.2	9.22	9.27	13	10.2	10.9	14.3
Copper (mg/kg)	290	395	279	270	251	1833	208	385	294	108	153	2286	297	371	378
Iron (mg/kg)	N/A	N/A	40,782	73,022	35,315	50,854	33,527	42,518	31,199	29,868	20,467	28,194	19,374	32,460	24,702
Lead (mg/kg)	86.9	149	545 J	128 J	186 J	468 J	387 J	144 J	172 J	201 J	147 J	157	249 J	215 J	189 J
Manganese (mg/kg)	N/A	N/A	4880 J	387 J	2627 J	4581 J	3205	1884	2133	2623 J	1316 J	1884	2256 J	1909 J	1884 J
Mercury (mg/kg)	N/A	N/A	0.025 U	0.025 U	0.034 U	0.046 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U
Molybdenum (mg/kg)	3.78	5.48	5.3	16.7	5.63	9.97	3.15	8.33	9.37	4.79	10.5	6.59	5.48	12.2	5.86
Nickel (mg/kg)	6.51	14.7	18	3.15 U	10.3	9.81	4.05 U	3.8 UJ	4.29 U	9.8	7	4.02 U	6.39	9.18	7.22
paste pH (SU)	N/A	N/A	7.34	2.55	7.84	5.46	4.87	4.57	6.8	7.79	7.55	8.16	7.68	7.68	7.68
Selenium (mg/kg)	0.51	0.28	0.54 U	1.28 UJ	0.58 U	0.79 U	0.182 U	1.26	0.369	0.13 U	0.249 UJ	0.73 U	0.185 U	0.337 U	0.39 U
Silver (mg/kg)	N/A	N/A	0.35 U	0.35 U	0.35 U	0.35 U	0.424 U	0.515 U	0.542 U	0.35 U	0.35 U	0.35 U	0.545 U	0.35 U	0.416 U
Thallium (mg/kg)	N/A	N/A	1.1 U	0.29 UJ	0.11 UJ	0.38 UJ	0.11 UJ	0.11 UJ	0.11 UJ	0.11 U	0.11 U	0.11 U	0.327 UJ	0.322 UJ	0.11 U
TOC (mg/kg)	N/A	N/A	0.19	0.35	1.61	2.61	0.38	0.23	0.4	0.23	0.1	0.34	0.1	0.19	0.08
Vanadium (mg/kg)	N/A	N/A	24.6	25.6	32.8	38.4	27.3	24.6	32.8	33.1	26.6	22.5	16.4	27.8	13.6
Zinc (mg/kg)	278	969	4144	1273	1901	2124	857	580	926	850	419	536	2934	2376	995

N/A: Not Available
U: Result not detected
J: Result estimated

Appendix Table 3 (A-3)
All Sediment Data
Hanover and Whitewater Creeks Investigation Unit

Parameter	U02-1105	U02-2100	U02-2102	U02-3100	U02-3102	U03-1000	U03-1001	U03-1002	U03-5200	U03-5201
Aluminum (mg/kg)	4287	5435	5785	5530	11,586	4561	4479	22,700	8183	11,375
Antimony (mg/kg)	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	R	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	5.68 UJ
Arsenic (mg/kg)	6.74 J	3.57 J	6.03	4.8 J	2.63	3.74	4.34	2.32	1.75 J	5.91
Barium (mg/kg)	49.3	51.2	53.3	73.1	152	113	88.3	175	92.3	144
Beryllium (mg/kg)	0.161 U	0.137 U	0.198 U	0.254 U	0.409 U	0.305	0.326	1	0.312 U	0.405 U
Boron (mg/kg)	5.19 U	10.1	9.18	5.37 U	3.46 U	2.75 U	2.75 U	7.65	3.54 U	3.53 U
Cadmium (mg/kg)	1.79 J	4.98 J	3.79	11.5 J	2.84	1.99	2.37	1.45	1.22 J	8.89
Calcium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (mg/kg)	10.3	14	16.2	12.9	12.5	4.32	4.81	12	9.39	10.4
Cobalt (mg/kg)	13	14.9	13.8	12.8	14.4	3.44	4.45	6.25	13	20.1
Copper (mg/kg)	366	484	499	476	163 J	318	257	249	759	1338
Iron (mg/kg)	29,900	39,227	43,870	29,250	28,016	8627	9769	17,708	22,684	23,838
Lead (mg/kg)	200 J	178 J	176 J	334 J	271 J	1850 J	2528 J	522 J	312 J	828 J
Manganese (mg/kg)	1210 J	1575 J	1429	2358 J	2441	445	529	536	1731 J	2874
Mercury (mg/kg)	0.025 U	0.025 U	0.025 U	0.025 U	0.0379 UJ	0.025 U	0.0276 U	0.025 U	0.025 U	0.033 U
Molybdenum (mg/kg)	13.4	7.17	9.76	9.41	1.9 U	4.47	2.26 U	1.66 U	9.96	5.7
Nickel (mg/kg)	4.23 U	3.15 U	4.13 U	8.45	4.47 U	3.15 U	3.15 U	4.64 U	3.15 U	4.17 U
paste pH (SU)	7.68	7.68	7.68	7.68	5.36	4.93	2.54	4.45	8.16	8.16
Selenium (mg/kg)	0.403 UJ	0.287 U	0.535	0.64 U	0.208 U	0.13 U	0.13 U	0.13 U	0.447 U	0.331
Silver (mg/kg)	0.35 U	0.35 U	0.35 U	0.405 U	0.982	2.08	1.62	1.74	0.442 U	0.906 U
Thallium (mg/kg)	0.11 UJ	0.362 UJ	0.412 UJ	0.531 UJ	0.11 UJ	0.11 UJ	0.11 UJ	0.11 UJ	0.11 U	0.234 UJ
TOC (mg/kg)	0.09	0.12	0.17	0.48	0.48	0.28	0.09	0.61	0.34	0.34
Vanadium (mg/kg)	17.1	32	33.1	20	36.7	24.7	48.1	34.4	16.5	27.1
Zinc (mg/kg)	1001	2076	1396	4637	1171	540	528	313	482	4299

Parameter	U03-5500	U03-5501	U03-5502	U03-5503	U03-1200	U03-1202	U03-1300	U03-1302	U03-1304	U03-1306
Aluminum (mg/kg)	9,658	8,247	27,519	27,175	3,192	5457	7798	7554	5010	7175
Antimony (mg/kg)	4.95 U	4.95 U	4.95 UJ	4.95 UJ	4.95 UJ	6.85 UJ	4.95 UJ	4.95 UJ	4.95 UJ	6.39 UJ
Arsenic (mg/kg)	1.06 J	3.71	5.64 J	6.72 J	5.48	6.71	6.04	3.95	7.32	8.42
Barium (mg/kg)	124	132	221	212	50.1	68	65.9	91.8	55	69.7
Beryllium (mg/kg)	0.279 U	0.819	1.42	1.36	0.219 U	0.241 U	0.638	0.34 U	0.258 U	0.312 U
Boron (mg/kg)	3.86 U	2.36 U	4.67 J	2.13 UJ	N/A	8.04	7.05	3.87 U	10.4	13.3
Cadmium (mg/kg)	1.17	6.43	10.1	8.1	3.04	3.55	2.07 J	1.29	0.533 U	1.46
Calcium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (mg/kg)	11.8	11	24.5	41.4	6.33	15.2	22.6	17.7	20.9	21.7
Cobalt (mg/kg)	10.3	8.39	11.9	14.1	11.2	13.9	8.35	10.8	7.58	10.7
Copper (mg/kg)	260	1641	3366	2859	329	479	469	354	499	586.64
Iron (mg/kg)	11,950	17,175	41,194	73,604	17,459	38,198	43,554	31,998	47,218	54,879
Lead (mg/kg)	15	70.9	80.9	98.4	56.007 J	58.6 J	223 J	131 J	203 J	260 J
Manganese (mg/kg)	275	163	214 J	242 J	411	438	1111	868	459	964
Mercury (mg/kg)	0.025 U	0.025 U	0.095	0.067	0.006 U	0.006 U	0.025 U	0.025 U	0.025 U	0.025 U
Molybdenum (mg/kg)	3.28 U	24.7	45.6	81.1	2.891	4.07	8.20	6.92	9.11	10.7
Nickel (mg/kg)	6.31 U	4.83 U	14.5	17.1	1.084 U	1.40	6.97	3.81 U	3.23 UJ	8.5 J
paste pH (SU)	2.5	2.5	2.5	2.5	7.37	7.3	7.1	7.03	4.6	5.83
Selenium (mg/kg)	0.18 U	1.61	2.15	4.75	0.138 U	0.15	0.232 U	0.206 U	0.534	0.559
Silver (mg/kg)	0.358 U	0.35 U	0.636 U	0.506 U	0.079 U	0.08 U	2.29 J	0.41 U	0.505 U	0.742 U
Thallium (mg/kg)	0.11 UJ	0.129 UJ	0.11 UJ	0.819 U	0.025 UJ	0.25 UJ	0.25 UJ	0.11 UJ	0.11 UJ	0.11 UJ
TOC (mg/kg)	0.24	0.24	0.24	0.24	0.12	0.21	0.11	0.2	0.11	0.25
Vanadium (mg/kg)	18.5	18.3	29.9	33.8	3.25	6.95	28.5	25.6	21.8	34.7
Zinc (mg/kg)	69.6 J	100 J	192 J	198 J	418	382	1010	658	404	798

Parameter	U03-1307	U03-1309	U03-1311	U03-1313	U03-1315	U03-1317	U03-1400	U03-1500 B	U03-1600 B
Aluminum (mg/kg)	6544	5287	5174	5204	7525	6547	12,881	16,355	4617
Antimony (mg/kg)	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	4.53 U	3.2 UJ
Arsenic (mg/kg)	5.9	4.25	3.47	5.24	5.79 J	4.43 J	2.52 J	3.52	1.36
Barium (mg/kg)	83.9	61	49.2	70.4	90.9	79.2	162	170	52.7
Beryllium (mg/kg)	0.307 U	0.281 U	0.253 U	0.508	0.62	0.47	0.62	1.47	0.24
Boron (mg/kg)	6.32	5.27	2.75 U	6.05	2.75 UJ	2.75 UJ	2.79 UJ	10.87	7.40
Cadmium (mg/kg)	1.44	1.8	1.68	1.87	2.64	0.515 U	0.844	3.80	0.73
Calcium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (mg/kg)	18.9	19	15.1	15.7	20.5	17.8	14.9	17.2	7.9
Cobalt (mg/kg)	9.51	8.34	7.85	13	16.7	6.19	8.23	108	6.3
Copper (mg/kg)	453	469	374	462	594	287	272	2619	140
Iron (mg/kg)	41,312	40,654	29,487	35,096	39,610	37,248	23,177	30,812	16,751
Lead (mg/kg)	214 J	204 J	147 J	173 J	217	183	73.2	25.6	17.4
Manganese (mg/kg)	818	748	620	1115	1213 J	412 J	456 J	1345	261
Mercury (mg/kg)	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U
Molybdenum (mg/kg)	11.8	6.9	5.41	12.4	6.59	3.66	1.35 U	50.7	7.45
Nickel (mg/kg)	4.26 U	4.15 U	3.15 U	7.84	10.8	3.79 U	9.27	38.8	7.30
paste pH (SU)	5.85	6.79	7.37	7.87	6.69	5.99	7.21	N/A	N/A
Selenium (mg/kg)	0.563 J	0.411 J	0.262 J	0.178 U	0.13 UJ	0.13 U	0.13 UJ	1.98 J	0.13 UJ
Silver (mg/kg)	0.35 U	0.35 U	0.35 U	1.47	0.431 U	0.35 U	0.359 U	0.44 U	0.44 U
Thallium (mg/kg)	0.305 UJ	0.255 UJ	0.177 UJ	0.195 UJ	0.513 UJ	0.241 UJ	0.138 U	0.09 U	0.09 U
TOC (mg/kg)	0.19	0.09	0.08	0.07	0.26	0.15	0.27	N/A	N/A
Vanadium (mg/kg)	28.7	24	21.4	24.9	24.5	30.8	28	21.3	28.1
Zinc (mg/kg)	650 J	720 J	637 J	800	1016 J	345 J	198 J	451	62.8

N/A: Not Available
U: Result not detected
J: Result estimated

Appendix Table 3 (A-3)
All Sediment Data
Hanover and Whitewater Creeks Investigation Unit

Parameter	U03-1700 B	U03-1702 B	U03-1800	U03-1900 B	U03-1901 B	U03-1902 B	U03-2200	U03-2300	U03-2302	U03-2303
Aluminum (mg/kg)	2040	3118	7186	4084	4498	3226	8201	5485	4929	12,810
Antimony (mg/kg)	3.2 UJ	3.2 UJ	4.95 UJ	3.2 UJ	3.2 UJ	3.2 UJ	4.95 UJ	9.15 UJ	4.95 UJ	4.95 UJ
Arsenic (mg/kg)	1.29	1.25	1.85 J	1.12	1.51	1.82	8.83	7.57	8.78	5.97
Barium (mg/kg)	38.3	55.1	88.4	96.7	65.1	53.5	70.5	63.8	60.4	109
Beryllium (mg/kg)	0.17	0.19	0.16 U	0.23	0.19	0.21	0.35 U	0.26 U	0.16 U	0.83
Boron (mg/kg)	2.70 U	3.29 U	2.91 UJ	2.75 U	8.07	2.67 U	13.9	6.04	6.55	4.57 U
Cadmium (mg/kg)	0.32 U	0.32 U	0.41 U	1.34	0.28 U	0.43 U	5.67	2.19	1.09	2.62
Calcium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (mg/kg)	4.5	5.6	11	6.1	13.1	6.2	21.3	17.9	18.2	16
Cobalt (mg/kg)	5.2	5.3	6.82	5.3	5.7	5.3	17.5	11.4	5.38	45.4
Copper (mg/kg)	99.0	104	220	109	115	144	611	505	382	1307
Iron (mg/kg)	8376	10,009	19,484	12,433	20,935	12,703	54,800	38,393	38,422	34,934
Lead (mg/kg)	7.15	10.7	29.6	12.6	24.2	38.0	118 J	226 J	274 J	292 J
Manganese (mg/kg)	223	259	271 J	1099	398	318	625	879	653	2239
Mercury (mg/kg)	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.007 U	0.025 U	0.025 U	0.025 U
Molybdenum (mg/kg)	4.43	5.88	9.69	4.99	5.25	6.56	12.3	11.6	12.5	7.57
Nickel (mg/kg)	2.85 U	4.15 U	4.36 U	3.89 U	4.43 U	4.28 U	3.56 UJ	4.77 U	3.91 U	10.4
paste pH (SU)	N/A	N/A	4.38	N/A	N/A	N/A	5.66	6.21	3.92	6.17
Selenium (mg/kg)	0.15 UJ	0.13	0.33	0.13 UJ	0.10 UJ	0.13 UJ	0.42	0.64	0.72	0.499
Silver (mg/kg)	0.44 U	0.44 U	0.35 U	0.44 U	0.44 U	0.44 U	0.11 U	0.56 U	0.35 U	2.1
Thallium (mg/kg)	0.09 U	0.09 U	0.11 U	0.09 U	0.20	0.09 U	0.33 UJ	0.11 UJ	0.11 UJ	0.11 UJ
TOC (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	0.3	0.37	0.11	0.14
Vanadium (mg/kg)	16.3	17.8	24.1	23.9	37.1	19.7	14.7	23.8	23.5	29.6
Zinc (mg/kg)	28.1	44.6	65.7 J	191	81.4	104	664	894	413	1023

Parameter	U03-2305	U03-2306	U03-2307	U03-2309	U03-2311	U03-2312	U03-2313	U03-2315	U03-2316	U03-2318
Aluminum (mg/kg)	6058	7067	5489	7163	4614	8110	7900	12,308	13694	5650
Antimony (mg/kg)	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ
Arsenic (mg/kg)	5.59	6.45	6.69	7.97	6.84	7.47	5.19	4.9 J	6.5 J	5.88
Barium (mg/kg)	58.7	68.6	73.5	73.5	64.7	88.2	78.3	96	71.3	67.5
Beryllium (mg/kg)	0.46	0.223 U	0.30	0.70	0.189 U	0.332 U	0.342 UJ	0.70	0.91	0.211 UJ
Boron (mg/kg)	3.05 U	7.19	4.29 U	7.39	3.62 U	7.73	6.47	2.78 UJ	3.2 UJ	8.32
Cadmium (mg/kg)	2.01	1.76 J	0.41 U	2.06	3.19	0.541 U	0.41 U	0.95	0.99	0.636 U
Calcium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (mg/kg)	17.8	24	17.6	16.1	11.3	21.3	24.5	24.1	28.5	23.3
Cobalt (mg/kg)	11.4	8.39	8.71	15.4	8.85	10.5	7.96	12.1	13.0	6.17
Copper (mg/kg)	681	485	532	1085	978	393	439	573	1112	452
Iron (mg/kg)	31,075	45,893	32,872	35,069	22,356	44,765	46,225	49,326	49,987	46,480
Lead (mg/kg)	227 J	248 J	294 J	340 J	239 J	217 J	413 J	180	404	198 J
Manganese (mg/kg)	1009	754	783	1461	854	917	1008	721 J	617 J	587
Mercury (mg/kg)	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.0427	0.025 U	0.025 U	0.025 U	0.025 U
Molybdenum (mg/kg)	7.61	9.41	8.7	10.2	8.74	7.63	11.6	6.47	10.6	10
Nickel (mg/kg)	3.15 U	4.67 U	3.15 U	8	4.93 U	3.15 U	3.15 U	8.41	8.56	4.03 U
paste pH (SU)	4.45	6.3	4.73	6.02	6	4.15	4.26	4.52	3.73	3.86
Selenium (mg/kg)	0.70	0.816 J	0.56	0.50	0.644 J	0.64	0.49	0.13 UJ	0.446 UJ	0.61
Silver (mg/kg)	2.14	1.86 J	1.86	5.1	1.15	0.35 U	0.35 U	0.35 U	0.404 U	0.35 U
Thallium (mg/kg)	0.172 UJ	0.333 UJ	0.172 UJ	0.11 UJ	0.11 UJ	0.398 UJ	0.335 UJ	0.11 UJ	1.1 U	0.362 UJ
TOC (mg/kg)	0.19	0.16	0.15	0.25	0.34	0.15	0.17	0.26	0.27	0.12
Vanadium (mg/kg)	18.5	26.6	19.3	26.9	17.9	35	32.2	47.1	36.6	28
Zinc (mg/kg)	1055	717	469	852	1289	353 J	339 J	342 J	362 J	410 J

Parameter	U03-2320	U03-2321	U03-2322	U03-2600 B	U03-2602 B	U03-2800	U03-2900 B	U03-2901 B	U03-3003
Aluminum (mg/kg)	6733	6678	5480	2774	2805	6083	4801	4056	3821
Antimony (mg/kg)	4.95 U	4.95 U	4.95 U	3.2 UJ	3.2 UJ	4.95 UJ	3.2 UJ	3.2 UJ	4.95
Arsenic (mg/kg)	5.8	7.24	5.46	1.70	2.51	1.56 J	1.42	1.67	1.44
Barium (mg/kg)	75.8	69.7	73.8	67.3	57.8	105	71.5	80.5	78.0
Beryllium (mg/kg)	0.171 UJ	0.161 UJ	0.125 UJ	0.17	0.17	0.106 U	0.20	0.20	0.40
Boron (mg/kg)	7.86	6.39	6.02	4.73 U	3.64 U	2.75 UJ	3.50 U	3.78 U	2.75
Cadmium (mg/kg)	0.613 U	0.41 U	0.76	0.28 U	2.47	0.41 U	0.59	0.28 U	0.59
Calcium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (mg/kg)	26.8	24	24.7	7.97	5.79	12.2	6.87	8.26	3.62
Cobalt (mg/kg)	4.16	4.68	3.82	2.51	6.41	5.06	5.86	4.75	3.43
Copper (mg/kg)	422	438	396	104	325	193	139	179	149
Iron (mg/kg)	48,879	45,107	43,030	22,744	12,316	22,612	13,168	18,710	5016
Lead (mg/kg)	204 J	213 J	239 J	9.99	48.3	16.9	19.4	24.2	316
Manganese (mg/kg)	458	437	378	129	270	179 J	274	290	403
Mercury (mg/kg)	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.03
Molybdenum (mg/kg)	9.28	9.27	7.8	12.8	14.6	21.2	9.89	16.4	3.14
Nickel (mg/kg)	4.43 U	3.15 U	3.15 U	2.85 U	4.20 U	3.15 U	7.60	4.51 U	3.15
paste pH (SU)	4.31	4.04	4.02	N/A	N/A	4.17	N/A	N/A	3.24
Selenium (mg/kg)	0.87	0.85	0.62	1.08 J	0.31 UJ	0.8	0.18 UJ	0.39 J	0.13
Silver (mg/kg)	0.35 U	0.35 U	0.35 U	0.44 U	0.44 U	0.504 U	0.44 U	0.44 U	0.77
Thallium (mg/kg)	0.402 UJ	0.463 UJ	0.11 UJ	0.09 U	0.09 U	0.11 U	0.09 U	0.09 U	0.11
TOC (mg/kg)	0.13	0.15	0.11	N/A	N/A	N/A	N/A	N/A	0.56
Vanadium (mg/kg)	27.8	26.4	23.3	18.9	13.5	22	17.5	21.6	12.9
Zinc (mg/kg)	288 J	308 J	284 J	10.9	141	36.1 J	60.1	97.3	137

N/A: Not Available
U: Result not detected
J: Result estimated

Appendix Table 3 (A-3)
All Sediment Data
Hanover and Whitewater Creeks Investigation Unit

Parameter	U03-3004	U03-3200	U03-3300	U03-3302	U03-3303	U03-3305	U03-3306	U03-3308	U03-3309
Aluminum (mg/kg)	7365	8338	6977	11,307	5844	14,087	10,972	6361	10,077
Antimony (mg/kg)	4.95	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ
Arsenic (mg/kg)	2.95	6.35 J	3.31	8.05	10.2	1.43 U	4.3	2.11	1.21
Barium (mg/kg)	87.2	68.7	125	98.3	80.1	128	99.4	116	149
Beryllium (mg/kg)	0.25	0.398 U	0.246 U	0.512 U	0.214 U	0.356 U	0.257 U	0.404 U	0.361 U
Boron (mg/kg)	2.75	2.75 U	3.51 U	9.27	2.75 U	5.19 U	5.9	2.75 U	2.75 U
Cadmium (mg/kg)	1.35	1.71	2.92 J	6.56 J	3.24 J	1.93 J	3.31 J	1.71 J	0.41 U
Calcium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (mg/kg)	6.19	18.3	9.25 J	22.7 J	13.1 J	16.5 J	16.5 J	7.12 J	8.53 J
Cobalt (mg/kg)	7.17	28.4	8.15 J	24.3 J	12.5 J	11.9 J	12 J	7.2 J	6.44 J
Copper (mg/kg)	510	984	3250	1439	780	518	771	601	242
Iron (mg/kg)	1836	43,846	13,285	40,653	27,890	25,058	29,738	9445	11,532
Lead (mg/kg)	1836	147.1	537	363	323	138	233	89	38.1
Manganese (mg/kg)	575	513	1578	1838	1191	1089	1169	929	619
Mercury (mg/kg)	0.03	0.011 UJ	0.201	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U
Molybdenum (mg/kg)	7.1	10.6	11.6	11.3	7.73	10.5	5.54	3.65	1.78 U
Nickel (mg/kg)	3.15	1.49 U	3.15 U	11.1 J	5.43 J	11.3 J	9.88 J	7.75 J	5.92 J
paste pH (SU)	2.5	5.38	7	6.43	5.07	7.75	7.55	7.40	7.30
Selenium (mg/kg)	0.27	0.51	0.63	0.53	0.51	0.13 U	0.13 U	0.13 U	0.13 U
Silver (mg/kg)	3.71	0.39	0.875 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U
Thallium (mg/kg)	0.11	UJ	0.11 U	0.11 UJ	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U
TOC (mg/kg)	0.24	0.4	3	0.6	1.03	1.17	0.76	1.77	1.09
Vanadium (mg/kg)	24.7	9.57 U	15.7 J	29.9 J	17.5 J	33.7 J	34.2 J	16.6 J	18.6 J
Zinc (mg/kg)	393	317	733 J	2528 J	1228 J	755 J	1215 J	384 J	144 J

Parameter	U03-3311	U03-3312	U03-3314	U03-3316	U03-3317	U03-3318	U03-3320	U03-3321	U03-3322
Aluminum (mg/kg)	7807	10,095	7825	11,231	16,767	6530	6547	7222	5416
Antimony (mg/kg)	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ
Arsenic (mg/kg)	0.67	2.93 J	2.9 J	2.49 J	2.27 J	5.55	6.05 J	1.31 J	3.66 J
Barium (mg/kg)	119	102	94.9	106	164	86.4	85.2	103	78.6
Beryllium (mg/kg)	0.297 U	0.326 U	0.479	0.307 U	0.655	0.315 U	0.281 U	0.279 U	0.234 U
Boron (mg/kg)	3.7 U	7.35	2.75 U	3.76 U	2.75 U	2.75 U	2.75 U	2.75 U	2.75 U
Cadmium (mg/kg)	0.41 U	1.67	1.6	1.5	1.18	2.75 J	4.05	0.955 U	3.04
Calcium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (mg/kg)	5.34 J	14.6	13.9	15.9	15.3	11.3 J	12.6	4.7	11.4
Cobalt (mg/kg)	5.1 J	7.89	7.4 J	8.57 J	8.12 J	10.8 J	11.8	4.89 J	9.3 J
Copper (mg/kg)	133	782	714	833	585	952	1454	957	1175
Iron (mg/kg)	8675	24,087	17,807	23,369	20,307	18,697	23,663	8413	18,148
Lead (mg/kg)	16.3	120	116	110	63.3	133	193	33.1	131
Manganese (mg/kg)	498	964	939	941	797	897	1056	494	969
Mercury (mg/kg)	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.0351 U	0.025 U
Molybdenum (mg/kg)	2.04 U	6.09	4.96	3.35 U	3.55	5.08	6.88	5.13	3.96
Nickel (mg/kg)	4.18 U	4.13 U	6.95	8.93	10.9	6.68 J	4.94 U	5.21 U	4.75 U
paste pH (SU)	7.08	7.08	7.08	7.08	7.08	7.08	7.08	7.08	7.08
Selenium (mg/kg)	0.13 U	0.361	0.13 U	0.354	0.328	0.36	1.29	0.485	0.587 J
Silver (mg/kg)	0.35 U	0.93	0.35 UJ	0.35 UJ	0.688 J	0.35 U	0.35 UJ	0.35 UJ	0.881 J
Thallium (mg/kg)	0.11 U	R	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U
TOC (mg/kg)	0.66	0.72	0.6	0.72	2.87	0.68	0.53	1.22	0.28
Vanadium (mg/kg)	14.7 J	21.2 U	22.2	30	31.7	21.2 J	22.4	13.2	18.5
Zinc (mg/kg)	94.1 J	467	494	462	265	879 J	1457	254	1126

Parameter	U03-3400	U03-3500	U03-3600	U03-3602	U03-3604	U03-3800	U03-3900	U03-3901
Aluminum (mg/kg)	13,103	7134	7110	10,002	3125	4608	10,095	8188
Antimony (mg/kg)	4.95 UJ	R	R	4.95	4.95 UJ	R	4.95 UJ	4.95 UJ
Arsenic (mg/kg)	2.22 J	0.974	1.19	0.862	1.67 J	1.32	2 J	1.16 J
Barium (mg/kg)	182	106	113	125	99.5	84.6	118	83.7
Beryllium (mg/kg)	0.585 U	0.254 U	0.415 U	0.427	0.113 U	0.184 U	0.199 U	0.231 U
Boron (mg/kg)	8.49	4.28 U	3.46 U	2.75	2.75 UJ	2.75 U	3.38 UJ	3.51 U
Cadmium (mg/kg)	2.42	0.705 U	0.41 U	0.41	0.41 U	0.41 U	0.41 U	0.41 U
Calcium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (mg/kg)	9.58	11.3	8.65 J	12.921	6.26	6.19	20	10.8
Cobalt (mg/kg)	10.1	22.3	9.76	6.718	5.43	6.48	8.51	4.61 J
Copper (mg/kg)	2384	980 J	342 J	190	285	297 J	346	541
Iron (mg/kg)	15,538	25,234	12,828	13,903	13,114	11,126	45,510	16,318
Lead (mg/kg)	53.2	8.05	10.6	9.28	16.1	39.4	15.5	35.2
Manganese (mg/kg)	381	315	307	333	94.1 J	481	224 J	577
Mercury (mg/kg)	0.0561	0.025 U	0.027 U	0.025	0.025 U	0.025 U	0.025 U	0.025 U
Molybdenum (mg/kg)	16.4	37	5.64 U	2.01	13.7	4.01	16.2	4.75
Nickel (mg/kg)	8.18	6.15	8.49	13.5	3.15 U	3.45 U	4.94	5.05 U
paste pH (SU)	7.12	4.35	4.04	4.45	3.98	5.78	7.53	7.4
Selenium (mg/kg)	1.56	1.96	0.56	0.59	1.01	0.197 U	0.776 U	0.185 U
Silver (mg/kg)	0.64	0.35 U	0.35 U	0.35	1.58	0.35 U	0.35 U	0.35 UJ
Thallium (mg/kg)	U	0.11 UJ	0.11 U	0.11	0.11 U	0.11 U	0.177 UJ	0.11 U
TOC (mg/kg)	2.18	0.15	0.84	0.3	0.49	0.08	0.48	0.13
Vanadium (mg/kg)	12.6 U	18.1	19.8	22.1	11.4	18.6	22.4	22.4
Zinc (mg/kg)	175	88.7	32.1	29.0	13.9 J	83.6	43.7 J	174

N/A: Not Available
U: Result not detected
J: Result estimated

Appendix Table 3 (A-3)
All Sediment Data
Hanover and Whitewater Creeks Investigation Unit

Parameter	U03-3902	U03-6300	U03-6600	U03-6900	ERA 22	ERA 23	ERA 26	ERA 27	ERA 28	ERA 29	ERA 31	ERA 32	ERA 33
Aluminum (mg/kg)	5070	13,813	9112	8929	10,780	13,933	7487	7420	10,320	5270	8263	10,900	5273
Antimony (mg/kg)	4.95 UJ	4.95 UJ	4.95 UJ	4.95 UJ	R	R	R	0.03	0.30	0.1 R	R	R	0.06 R
Arsenic (mg/kg)	1.42 J	2.51 J	0.86 J	2.10 J	3.6 J	1.73 UJ	1.11 UJ	0.68	2.8	2.83 U	0.68 UJ	3.87 J	2.27
Barium (mg/kg)	74.1	150	126	98.5	97.6	146	129	97.3	99.8	74.3	138	190	91.5
Beryllium (mg/kg)	0.243	0.65	0.28 U	0.64	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Boron (mg/kg)	2.75 U	2.75 U	2.75 U	2.75 U	2.83 J	4.23 J	2.8 J	2.6 U	5.1 UJ	1.4 UJ	1.83	2.87 UJ	1.27
Cadmium (mg/kg)	0.41 U	0.71 U	0.41 U	0.41 U	4.93	1.6	0.553	0.703	3.47	6.00	0.86	19.1	1.3
Calcium (mg/kg)	N/A	N/A	N/A	N/A	11,090	3540	1203	3420	9213	14,633	12,350	26,353	2573
Chromium (mg/kg)	7.12	14.5	11.4	13.5	9.8	8.5 J	6.00	6.73	10.8 J	8.17 J	8.03 J	6.27 U	3.8 J
Cobalt (mg/kg)	4.81 J	9.72	11.3	6.04 J	26.1	9.05 J	3.45	5.65	11.4 J	12.4	5.95 J	10.2 J	4.5
Copper (mg/kg)	981	662	360	98.1	1120	973	535	328	1060	459.7	77.7 J	419.5 J	176.2
Iron (mg/kg)	11,431	18,618	20,597	15,270	27,900	19,800	16,333	16,800	29,367	23,133	10,666	28,100	6733
Lead (mg/kg)	30.1	46.1	8.19	24.2	161	21.4	13.7	34.6	223 J	365.7 J	11.68 U	2128	551.3 J
Manganese (mg/kg)	397	931	365	503	1140 J	289	126 J	520	991	2050 J	383	2807	435 J
Mercury (mg/kg)	0.025 U	0.03 U	0.03 U	0.03 U	0.033 J	0.037 J	0.027 J	0.01	0.023 J	0.01 UJ	0.01 U	0.05 U	0.043 U
Molybdenum (mg/kg)	9.79	4.52	5.27 U	1.35 U	9.2	14.1	16.8	5.25	9.4 J	5.5	1.1 U	6.8 J	3.5
Nickel (mg/kg)	3.34 U	11.7	5.68 U	4.42 U	12.3	11.7	5.37	7.77	9.57 J	8.43	12.7	7.67 J	4.17
paste pH (SU)	5.36	7.08	3.71	7.34	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium (mg/kg)	0.221 U	0.25	0.52 U	0.13 U	0.47 J	0.73	1.03 J	0.39	0.56	0.427	0.13 U	0.35 U	0 .11 U
Silver (mg/kg)	0.35 U	0.35 UJ	0.35 UJ	0.35 UJ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Thallium (mg/kg)	R	0.11 U	0.11 U	0.11 U	0.14	0.11	0.09	0.12	0.14	0.12	0.09	0.32	0.10
TOC (mg/kg)	0.48	0.66	0.56	0.19	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium (mg/kg)	17.1	30.4	19.0	26.5	15.6	12.8	9.2	16.6 J	15.1 J	10.2 J	14 J	21.7 J	17.7 J
Zinc (mg/kg)	109	204	36.1	88.1	1520	35.6	18.1	108 J	1182	2240	37.93	8350	243

Parameter	U03-51050	U03-51052	U03-51053	U03-51055	U03-51056	U03-51058	U03-51060	U03-51062	U03-51063	U03-11150	U03-11254	U03-11255	U03-11256
Aluminum (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Antimony (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Barium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Beryllium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Boron (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium (mg/kg)	0.09 J	0.6	0.26	0.22 J	0.14 J	0.41 J	0.98	0.24	0.75	0.24 J	0.02 UJ	0.19 J	0.34
Calcium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (mg/kg)	9.0	14.8	15.2	16.2	19	20.5	16	15.3	15.4	5.9 J	6.5 J	7.6 J	4.9
Cobalt (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper (mg/kg)	208	335	210	171	196	263	482	76.4	92.2	183 J	233 J	281 J	118
Iron (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lead (mg/kg)	23.3	34.3	24.4	21.6	24.7	24.4	47.4	11.1	17.5	21	21.2	25.1	18.9
Manganese (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mercury (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Molybdenum (mg/kg)	21.1	11.3	4.4	4.4	2.2 J	3.8 J	11.2	2.8 J	1.5 J	13.5	32.4	20.8	11.9
Nickel (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
paste pH (SU)	4.18	4.73	3.87	7.38	3.72	4.3	6.33	7.83	7.87	4.62 J	4.09 J	4.42 J	4.37 J
Selenium (mg/kg)	0.38 J	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ	0.1	0.1 UJ	0.1 UJ	0.3 J	0.46 J	0.81 J	0.23 J
Silver (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Thallium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TOC (mg/kg)	0.03	0.52	0.41	0.75	0.47	0.48	0.65	1.08	0.31	0.19	0.44	0.28	0.69 J
Vanadium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc (mg/kg)	50.8	130	109	71.5	102	140	225	54.4	110	70.1	69.3	66.2	55.9

N/A: Not Available
U: Result not detected
J: Result estimated

Appendix Table 3 (A-3)
All Sediment Data
Hanover and Whitewater Creeks Investigation Unit

Parameter	U03-11260	U03-11261	U03-11262	U03-11284	U03-11288	U03-11366	U03-11471	U03-11576	U03-11579	U03-11586	U03-11680	U03-11682	U03-31152	U03-31259
Aluminum (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Antimony (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Barium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Beryllium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Boron (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium (mg/kg)	0.66	0.66	0.49	0.49	0.31	0.27	0.62	0.35	0.77 J	1.4	0.02 U	0.19	0.35 J	0.24
Calcium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (mg/kg)	23.4	22.4	15.9	11.0	11.9	8.9	12.5	6.4	14.2 J	23.4	18.4	19.4	7.3 J	9.8
Cobalt (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper (mg/kg)	2360	2000	465	429	784	159	388	157	463 J	941	43	40.5	314 J	261
Iron (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lead (mg/kg)	42.9	41.4	36	33.9	38.8	34.3	36.1	22.4	41.6 J	90.3	18.9	20.2	32.3	25
Manganese (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mercury (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Molybdenum (mg/kg)	24 J	20.8 J	8 J	16.9 J	18.9	10.3 J	9.1	6.9 J	10.6 J	11.1 J	2	2	6.9	15.3
Nickel (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
paste pH (SU)	6.57 J	6.31 J	4.65 J	6.31 J	6.49 J	7.85 J	7.34 J	6.41 J	7.01 J	5.72 J	7.55 J	8.08 J	6.48 J	6.83 J
Selenium (mg/kg)	0.44 J	0.34 J	R	0.36 J	0.39 J	R	0.16 UJ	R	R	0.45 J	0.16 UJ	0.16 UJ	0.18 J	0.19 J
Silver (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Thallium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TOC (mg/kg)	1.06	1.84	1.07	0.46	0.8 J	0.07	0.94 J	0.07	0.8	1.03	0.22 J	0.16 J	0.53	0.51 J
Vanadium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc (mg/kg)	204	227	158	125	148	103	168	89.1	195 J	378	71	74.5	113	77

Parameter	U03-31264	U03-31368	U03-31578	U03-61153	U03-61258	U03-61265	U03-61369	U03-61474	U03-61575	LW-03E-S01-SD	LW-03E-S02-SD	LW-03E-S03-SD	LW-03E-S04-SD	LW-03E-S05-SD
Aluminum (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	11,600	13,100	17,000	12,100	13,800
Antimony (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ
Arsenic (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.2	3	4.9	3.1	2.7
Barium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	140 J+	153 J+	171 J+	149 J+	162 J+
Beryllium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Boron (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2	3	3	2	4
Cadmium (mg/kg)	0.39	0.45	0.49	0.57 J	0.3	0.28	0.22	0.17	0.29	0.5	1.06	0.95	1	0.69
Calcium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (mg/kg)	11.7	14.1	10.4	10 J	17.6	16.7	17.2	14	9.7	10.1	12.7	20.6	12.7	12.1
Cobalt (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12	23	10	10	8
Copper (mg/kg)	343	266	371	761 J	236	128	101	43.4	93.9	439	779	756	542	731
Iron (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20,200	20,500	24,900	19,000	27,400
Lead (mg/kg)	41.2	42.6	29.9	73.5	28.7	29.3	25.9	13.9	30.4	24.5	30.9	40.7	32.6	27.5
Manganese (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	357	847	405	651	271
Mercury (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Molybdenum (mg/kg)	14.8 J	4.2 J	11.2 J	6.3	5.4	4.1 J	2.3	2	2.4	18.5	16.7	25	12.2	22.3
Nickel (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7.8	15.1	16.7	14.6	9.3
paste pH (SU)	7.49 J	7.86 J	6.84 J	6.83 J	6.2 J	7.7 J	7.39 J	7.83 J	7.84 J	4	4.9	3.9	5.8	3.7
Selenium (mg/kg)	0.29 J	R	R	0.16 UJ	0.16 UJ	R	0.16 UJ	0.16 UJ	0.16 UJ	0.7	0.25	0.7	0.25	0.7
Silver (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Thallium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.27 U	0.16 U	0.24 U	0.13 U	0.14 U
TOC (mg/kg)	0.71	0.82	0.43	0.96	0.88 J	0.97	0.7 J	0.8 J	0.49 J	0.4	0.4	0.7	0.3	0.4
Vanadium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	23.9	28.9	30	27.6	26.7
Zinc (mg/kg)	134	173	118	201	110	105	99.9	53.6	115	90	177	137	163	90

N/A: Not Available
U: Result not detected
J: Result estimated

Appendix Table 3 (A-3)
All Sediment Data
Hanover and Whitewater Creeks Investigation Unit

Parameter	U02-ER001	U02-ER002	U02-ER003	U02-ER004	U02-ER005	U02-ER006	U02-ER007	U02-ER009	U02-ER010	U02-ER011	U03-ER001	U03-ER002	U03-ER004	U03-ER005	U03-ER006
Aluminum (mg/kg)	6500	5120	7220	5400	5530	4630	4730	5000	4850	3500	5920	4600	6410	2940	3310
Antimony (mg/kg)	0.15 J	0.3 J	0.18 J	0.17 J	0.23 J	0.2 J	0.16 J	0.12 J	0.15 J	0.12 J	0.25 J	0.1 J	0.3 J	0.08 J	0.26 J
Arsenic (mg/kg)	7.9	8.7	10.2	8.8	3.4 J	3.8	4.1	4.5	10	1.6 J	2 J	1.7 J	2.4 J	1.7 J	1.2 J
Barium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Beryllium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Boron (mg/kg)	6.7	8.9	7.6	7.9	3 J	6.7	6.7	7.3	6.1	2 J	3 J	1 J	2.9 J	0.96 J	0.87 J
Cadmium (mg/kg)	4.6	5.5	6	4.7	4	3	2.9	3	1.4	2.5	2.9	2.4	1.5	0.49 J	0.26 J
Calcium (mg/kg)	7940	9040	8950	12,200	9830	12,600	12,700	15,200	7220	10,500	5050	8960	4870	1680	1880
Chromium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cobalt (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper (mg/kg)	549	618	449	438	544	441	463	585	423	249	622	307	387	111	358
Iron (mg/kg)	48,900	60,900	45,000	48,400	41,600	42,100	40,700	38,000	53,800	29,900	36,100	25,200	35,500	8440	11,400
Lead (mg/kg)	312	297	458	571	169	89.3	126	165	317	71.2	682	134	99	5.9	39.8
Manganese (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mercury (mg/kg)	0.02 J	0.3 U	0.03 J	0.02 J	0.06	0.3 U	0.01 U	0.008 U	0.3 U	0.02 J	0.02 U	0.02 J	0.02 J	0.02 U	0.02 J
Molybdenum (mg/kg)	8.1	9.2	5.7	8.1	6	7.9	9.1	9.2	9.3	3.5 J	7.1	2.5 J	5.3	1 J	1.6 J
Nickel (mg/kg)	3.6	5.6	3.7	3.5	16.1	3.9	4.5	5.3	4.1	12.2	13.8	11.3	15.2	6.2	8.1
paste pH (SU)	6.4	6.83	6.6	6.73	7.65	7.66	7.54	7.61	6.4	7.77	7.16	7.68	7.1	7.33	7.39
Selenium (mg/kg)	0.65 J	0.83 J	0.68 J	0.7 J	0.34 J	0.34 J	0.24 J	0.54 J	0.55 J	0.25 J	0.4 J	0.27 J	0.33 J	0.24 J	0.26 J
Silver (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Thallium (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TOC (mg/kg)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium (mg/kg)	30.2	32.1	28.1	26.7	18.1	36.4	33.6	27.7	30.1	15.5	20.2	14.4	20.3	14.7	14.5
Zinc (mg/kg)	1930	2510	2500	2040	1680	1360	1220	1460	886	958	335	979	707	24.2	43.2

N/A: Not Available
U: Result not detected
J: Result estimated

Appendix Table 4 (A-4)
Foliage Sample Results
Hanover and Whitewater Creeks Investigation Unit

Analyte	B45_8W-F-A	B47_2E-F-A	LW-03E-F-A	LW-03-F-A	LW-04-F-A	LW-05-F-A	LW-06-F-A	LW-07-F-A	O43_5W-F-A	O44_2E-F-A	O48_8E-F-A	SC-1-F	SC-2-F-A	SC-3-F
Aluminum (mg/kg)	103 J+	126 J+	500 J+	201 J+	535 J+	115 J+	163 J+	262 J+	90 J+	120 J+	144 J+	466	1560 J+	3870
Antimony (mg/kg)	0.1 UJ	0.2 J	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ	0.1 U	0.1 UJ	0.1 U
Arsenic (mg/kg)	0.15 UJ	0.15 UJ	0.15 UJ	0.15 UJ	0.15 UJ	0.15 UJ	0.15 UJ	0.15 UJ	0.15 UJ	0.15 UJ	0.15 UJ	0.15 U	0.15 UJ	0.15 U
Barium (mg/kg)	3.1 J	8.6 J	6.1 J	3.7 J	7.5 J	2.9 J	2.8 J	10 J	9.9 J	7.1 J	7.2 J	10.3	18.4 J	30.3
Boron (mg/kg)	44 J	27 J	39 J	14 J	40 J	8 J	18 J	40 J	28 J	9 J	55 J	26	39 J	34
Cadmium (mg/kg)	0.7 J	0.5 J	0.56 J	0.12 J	0.31 J	0.025 UJ	0.1 J	0.39 J	2.53 J	0.74 J	0.92 J	0.98	1.95 J	3.18
Chromium (mg/kg)	0.025 UJ	0.65 J	1.39 J	1.42 J	0.93 J	0.025 UJ	0.82 J	0.89 J	0.025 UJ	0.89 J	0.86 J	0.73	2.05 J	5.3
Cobalt (mg/kg)	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	3	4 J	19
Copper (mg/kg)	10.5 J	11.1 J	34.5 J	19.3 J	32.7 J	14 J	17.6 J	30 J	10.2 J	11.6 J	12.9 J	25.1	47.1 J	47.4
Iron (mg/kg)	284 J	326 J	892 J	296 J	733 J	143 J	218 J	334 J	278 J	362 J	456 J	528	1540 J	4900
Lead (mg/kg)	0.73 J	1.38 J	0.67 J	0.24 J	0.058 J	0.06 J	0.025 UJ	0.25 J	1.18 J	3.41 J	1.6 J	0.86	1.57 J	5.68
Manganese (mg/kg)	29.4 J	54.9 J	92.2 J	70.7 J	89.5 J	50 J	49.5 J	56.9 J	45.3 J	63.1 J	60.7 J	280	487 J	1050
Mercury (mg/kg)	0.035 UJ	0.05 UJ	0.045 UJ	0.05 UJ	0.05 UJ	0.045 UJ	0.035 UJ	0.05 UJ	0.03 UJ	0.04 UJ	0.035 UJ	0.04 UJ	0.04 UJ	0.045 UJ
Moisture Content (%)	64.2	54.5	55	52.6	43.2	42	52.5	48.4	38.7	33	56.2	65	55	67.1
Molybdenum (mg/kg)	18 J	13.1 J	1.3 J	3.4 J	1 J	17.2 J	1 J	21 J	1.2 J	2.2 J	14.9 J	0.4	0.6 J	0.6
Nickel (mg/kg)	0.15 UJ	0.3 J	2.4 J	1.2 J	1.9 J	0.4 J	0.5 J	0.6 J	0.3 J	0.3 J	0.4 J	3.4	4.9 J	10.5
Selenium (mg/kg)	0.25 UJ	0.25 UJ	0.25 UJ	0.25 UJ	0.25 UJ	1.1 J	0.25 UJ	0.25 UJ	0.25 UJ	0.25 UJ	0.25 UJ	0.25 U	0.25 UJ	0.25 U
Thallium (mg/kg)	0.025 UJ	0.025 UJ	0.025 UJ	0.06 J	0.025 UJ	0.025 UJ	0.025 UJ	0.28 J	0.025 UJ	0.025 UJ	0.09 J	0.18	0.025 UJ	0.06
Vanadium (mg/kg)	0.25 UJ	0.25 UJ	2.3 J	1.6 J	1.1 J	0.25 UJ	0.25 UJ	0.7 J	1.5 J	0.7 J	0.25 UJ	0.7	1.6 J	8
Zinc (mg/kg)	101 J	112 J	77 J	56 J	89 J	18 J	31 J	81 J	98 J	152 J	123 J	65	90 J	123

U: Result was not detected

J, J+: Result estimated

Appendix Table 5 (A-5)
Seed Head Sample Results
Hanover and Whitewater Creeks Investigation Unit

Analyte	B45_8W-S	B47_2E-S	O43_5W-S-A	O44_2E-S	O48_8E-S
Aluminum (mg/kg)	208	223	115	147	169
Antimony (mg/kg)	0.2	0.1 U	0.1 UJ	0.1 U	0.1 U
Arsenic (mg/kg)	0.15 U	0.03 U	0.15 UJ	0.035 U	0.03 U
Barium (mg/kg)	8.2	10.9	14.3 J	8.3	11.1
Boron (mg/kg)	15	21	13 J	17	25
Cadmium (mg/kg)	0.23	0.17	0.13 J	0.1	0.11
Chromium (mg/kg)	0.99	0.61	0.025 UJ	0.99	0.6
Cobalt (mg/kg)	1	1	0.5 UJ	1	1
Copper (mg/kg)	16.9	5.19	11.9 J	3.52	4.42
Iron (mg/kg)	525	603	310 J	477	509
Lead (mg/kg)	11.1	3.02	2.9 J	5.87	3.96
Manganese (mg/kg)	93.3	74.9	114 J	90.8	67.5
Mercury (mg/kg)	0.04 UJ	0.05 UJ	0.035 UJ	0.15 J	0.04 UJ
Moisture Content (%)	51.7	48	9.5	55.7	60.1
Molybdenum (mg/kg)	3.9	2.95	0.7 J	0.21	1.4
Nickel (mg/kg)	0.7	0.13	0.4 J	0.17	0.19
Selenium (mg/kg)	0.25 U	0.25 U	0.25 UJ	0.25 U	0.25 U
Thallium (mg/kg)	.025 U	.005 U	0.025 UJ	.005 U	.005 U
Vanadium (mg/kg)	.25 U	.25 U	0.25 UJ	.25 U	.25 U
Zinc (mg/kg)	77	23.6	68 J	28.7	24.2

U: Result was not detected

J, J+: Result estimated

Appendix Table 6 (A-6)
Invertebrate Sample Results
Hanover and Whitewater Creeks Investigation Unit

Analyte	B45_8W-I	B47_2E-I	LW-03E-I	LW-03-I	LW-04-I	LW-06-I	LW-07-I	O43_5W-I	O44_2E-I	O48_8E-I	SC-1-I	SC-2-I	SC-3-I
Aluminum (mg/kg)	131	80	295	661	319	78	286	186	103	171	351	198	375
Antimony (mg/kg)	0.05U	0.05U	0.05U	0.05U	0.05U	0.05U	0.2	0.05U	0.05U	0.1U	0.05U	0.05U	0.05U
Arsenic (mg/kg)	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.1 U	0.05 U	0.05 U	0.05 U
Barium (mg/kg)	1.7	1.7	3.9	8.8	4.6	1.1	16.3	4.1	1.8	2.3	5.2	3.5	6.8
Boron (mg/kg)	2.8	0.6	0.25U	0.25U	2.5	1.2	3.2	2.2	2.4	0.5U	4.8	1.5	5.3
Cadmium (mg/kg)	0.88	0.22	0.17	0.3	0.09	0.15	1.2	0.61	0.81	0.32	0.11	0.2	0.11
Chromium (mg/kg)	0.01 U	0.01U	0.01 U	0.015 U	0.015 U	0.01 U	0.015 U	0.015 U	0.01 U	0.025 U	0.01 U	0.01 U	0.01 U
Cobalt (mg/kg)	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.5U	0.25 U	0.8	0.25U
Copper (mg/kg)	79.7 J+	11.5 J+	21.1 J+	30.8 J+	78 J+	41.4 J+	95.1 J+	54.9 J+	28.1 J+	29.2 J+	49.3 J+	55.5 J+	32.8 J+
Iron (mg/kg)	403	150	565	2000	512	107	329	775	495	468	623	394	646
Lead (mg/kg)	2.24	1.85	0.42	2.19	0.47	0.01U	2.83	5.76	2.57	1.52	0.6	0.05	0.3
Manganese (mg/kg)	28.7	41.5	35.6	73.1	26.5	12.8	16	61.3	42.5	44.5	18.7	15.6	24.3
Mercury (mg/kg)	0.02U	0.015U	0.02U	0.015U	0.015U	0.02U	0.015U	0.015U	0.02U	0.02U	0.015U	0.015U	0.02U
Percent Solids (%)	0.7	1.7	0.8	0.9	0.7	0.3	2.6	0.4	0.5	0.5	0.3	0.3	0.3
Molybdenum (mg/kg)	0.2	0.05U	0.5	0.8	0.4	0.2	0.3	0.4	0.2	0.15U	0.7	1	1.1
Nickel (mg/kg)	35.4	.05 U	29.6	31.1	38.5	32.8	0.1 U	34.8	34.4	0.15 U	35.4	35.7	38.9
Selenium (mg/kg)	0.1U	0.1U	0.1U	0.15U	0.15U	0.1U	0.15U	0.15U	0.1U	0.25U	0.1U	0.1U	0.1U
Thallium (mg/kg)	0.01U	0.01U	0.03	0.015U	0.015U	0.01U	0.09	0.015U	0.01U	0.025U	0.01U	0.01U	0.01U
Vanadium (mg/kg)	0.3	0.1U	0.5	2.1	0.6	0.1U	0.8	0.3	0.1U	0.25U	0.9	0.4	0.7
Zinc (mg/kg)	94.3	42.9	114	125	55.5	73.2	86.1	102	90.4	85	42.4	58.2	40.7

U: Result was not detected

J, J+: Result estimated

APPENDIX B

Hardness Based Water Quality Criteria

Appendix Table 1 (B-1)
Hardness Based Water Quality Criteria
Hanover and Whitewater Creeks Investigation Unit

Parameter	HC-51.6	U02-9100	WWC-38.1	U03-9200	U03-9000	LUCKY BILL U/S NO.5	LUCKY BILL AT NO.5	Lucky Bill Mouth	BAYARD/LB CON	BAYARD CANYON D/S	BAYARD CANYON U/S
	2006	1999	2006	1999	1999	2007	2007	2007	2007	2007	2007
Hardness (Calculated - mg/L)	1450	1740	1600	1314	86.2	126	158	180	172	155	179
Cadmium											
Acute Criteria (2)	0.027	0.032	0.030	0.025	0.002	0.003	0.003	0.004	0.003	0.003	**0.004**
Chronic Criteria (2)	**0.002**	**0.002**	**0.002**	**0.001**	0.0002	0.0003	0.0003	0.0004	**0.0004**	**0.0003**	**0.0004**
Chromium											
Acute Criteria (2)	5.09	5.91	5.52	4.70	0.50	0.83	0.69	0.92	0.89	0.82	0.92
Chronic Criteria (2)	0.66	0.77	0.72	0.61	0.07	0.11	0.09	0.12	0.12	0.11	0.12
Copper											
Acute Criteria (2)	0.17	0.20	**0.18**	0.15	0.01	0.02	0.02	0.02	0.02	**0.02**	**0.02**
Chronic Criteria (2)	0.09	0.10	**0.10**	0.08	**0.01**	0.01	0.01	0.02	0.01	**0.01**	**0.02**
Lead											
Acute Criteria (2)	0.99	1.16	1.08	0.90	0.05	0.11	0.08	0.12	0.12	0.10	0.12
Chronic Criteria (2)	0.04	0.05	0.04	0.04	0.002	0.004	0.003	0.005	0.005	0.004	0.005
Molybdenum											
Acute Criteria (2)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chronic Criteria (2)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium											
Acute Criteria (2)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Chronic Criteria (2)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Zinc											
Acute Criteria (2)	**1.13**	**1.32**	**1.23**	1.04	0.10	0.17	0.14	0.19	0.19	**0.17**	**0.19**
Chronic Criteria (2)	**1.14**	**1.33**	**1.24**	1.05	0.10	0.17	0.14	0.19	0.19	**0.17**	**0.19**

(2) calculated with equation 1b or 2a of 20.6.4.900[I] NMAc; As Amended through July 17, 2005.

Appendix Table 1 (B-1)
Hardness Based Water Quality Criteria
Hanover and Whitewater Creeks Investigation Unit

Parameter	BAYARD CANYON MID	U03-9001	U03-9002	BFT-1	BC-1	U03-9300	WWC-29.7	U03-9302	WWC-28.6	U03-9301	GRUNERUD-1
	2007	1999	1999	2006	2007	1999	2006	1999	2006	1999	2006
Hardness (Calculated - mg/L)	**143**	**168.4**	**35.9**	**22.9**	**169**	**75.7**	**515**	**740.7**	**1460**	**79**	**1820**
Cadmium											
Acute Criteria (2)	**0.003**	**0.003**	0.0007	0.0005	0.0034	0.002	0.010	0.014	0.027	0.002	0.034
Chronic Criteria (2)	**0.0003**	**0.0004**	0.0001	8.8E-05	**0.0004**	**0.0002**	**0.0008**	**0.0010**	**0.0016**	0.0002	**0.002**
Chromium											
Acute Criteria (2)	0.76	0.87	0.25	0.17	0.88	0.45	2.18	2.94	5.12	0.47	6.13
Chronic Criteria (2)	0.10	0.11	0.03	0.02	0.11	0.06	0.28	0.38	0.67	0.06	0.80
Copper											
Acute Criteria (2)	**0.02**	**0.02**	**0.01**	**0.00**	**0.02**	**0.01**	**0.06**	**0.09**	0.17	**0.01**	**0.21**
Chronic Criteria (2)	**0.01**	**0.01**	**0.00**	**0.00**	**0.01**	**0.01**	**0.04**	**0.05**	**0.09**	**0.01**	**0.11**
Lead											
Acute Criteria (2)	0.10	0.11	0.02	0.01	0.11	0.05	0.36	0.52	0.99	0.05	1.21
Chronic Criteria (2)	0.004	**0.004**	0.001	0.0005	0.004	0.002	0.014	0.02	0.039	0.002	0.047
Molybdenum											
Acute Criteria (2)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chronic Criteria (2)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium											
Acute Criteria (2)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Chronic Criteria (2)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Zinc											
Acute Criteria (2)	**0.16**	**0.18**	0.05	0.03	0.18	0.09	0.47	**0.64**	**1.14**	0.1	**1.37**
Chronic Criteria (2)	**0.16**	**0.18**	0.05	0.03	0.18	0.09	0.47	**0.64**	**1.15**	0.1	**1.38**

(2) calculated with equation 1b or 2a of 20.6.4.900[I] NMAc; As Amended through July 17, 2005.

Appendix Table 1 (B-1)
Hardness Based Water Quality Criteria
Hanover and Whitewater Creeks Investigation Unit

Parameter	B-RANCH	U03-9500	U03-9600	WWC-H180	U03-9900	LWWC-1	LWWCR.RANCHERSPOND
	2006	1999	1999	2006	1999	2006	2007
Hardness (Calculated - mg/L)	1770	109	431.5	725	225.1	347	228
Cadmium							
Acute Criteria (2)	**0.033**	**0.002**	**0.008**	0.014	0.0044	0.007	0.005
Chronic Criteria (2)	**0.002**	**0.0003**	**0.0007**	**0.001**	**0.0004**	**0.0006**	0.0004
Chromium							
Acute Criteria (2)	5.99	0.61	1.89	2.89	1.11	1.58	1.12
Chronic Criteria (2)	0.78	0.08	0.25	0.38	0.14	0.21	0.15
Copper							
Acute Criteria (2)	**0.20**	**0.02**	**0.05**	**0.09**	**0.03**	**0.04**	0.03
Chronic Criteria (2)	**0.10**	**0.01**	**0.03**	**0.05**	**0.02**	**0.03**	**0.02**
Lead							
Acute Criteria (2)	1.18	0.07	0.30	0.51	0.15	0.24	0.16
Chronic Criteria (2)	0.046	0.003	0.012	0.020	0.006	0.009	0.006
Molybdenum							
Acute Criteria (2)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chronic Criteria (2)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium							
Acute Criteria (2)	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Chronic Criteria (2)	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Zinc							
Acute Criteria (2)	**1.34**	0.13	**0.40**	**0.63**	0.23	**0.34**	0.24
Chronic Criteria (2)	**1.35**	0.13	**0.41**	**0.63**	0.23	**0.34**	0.24

(2) calculated with equation 1b or 2a of 20.6.4.900[I] NMAc; As Amended through July 17, 2005.